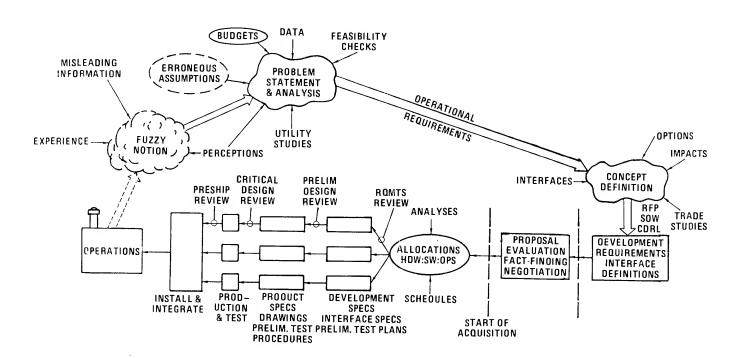
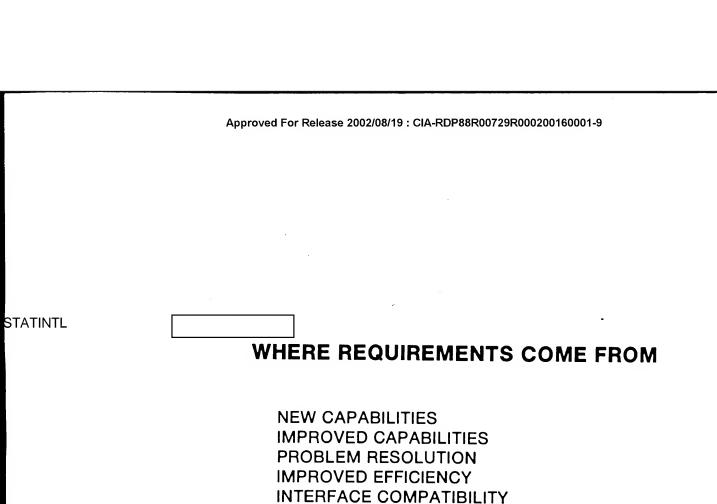
STATINTL



The System Lifecycle





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STATINTL

REQUIREMENTS DEFINITION PROCESSES

STATE THE PROBLEM
DEFINE THE PROPERTIES OF A SOLUTION

ORGANIZE, AMPLIFY & CLARIFY

RESOLVE CONTRADICTIONS & INCONSISTENCIES ESTABLISH DESIRED LEVELS OF PERFORMANCE

STATINTL

Concepts of Usage

WHO DOES IT SERVE?
HOW DO THEY WORK?
HOW DOES IT FIT IN?
HOW DO WE THINK THEY WILL USE IT?
WHAT SUPPORT DOES IT NEED?
WHO WILL PROVIDE THAT SUPPORT?

STATINTL

BUDGETARY COST ESTIMATES

CONTROLLABLE ELEMENTS

Requirements
Design
Manufacturing

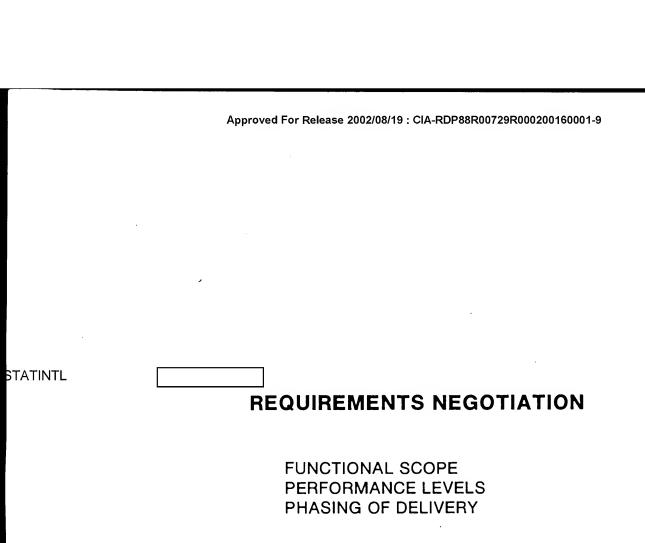
TASKS
Test
Documentation
Lifecycle Support

UNCONTROLLABLE ELEMENTS

Inflation
Exchange Rates
Stretch-Out
Mission Urgency

CONTINGENCIES

Requirements Growth or Change Technical Risk Staffing Delays



STATINTL

BUDGETARY COST ESTIMATES

CONTROLLABLE ELEMENTS

Requirements

Design

Manufacturing

TASKS

Test

Documentation

Lifecycle Support

UNCONTROLLABLE ELEMENTS

Inflation

Exchange Rates

Stretch-Out

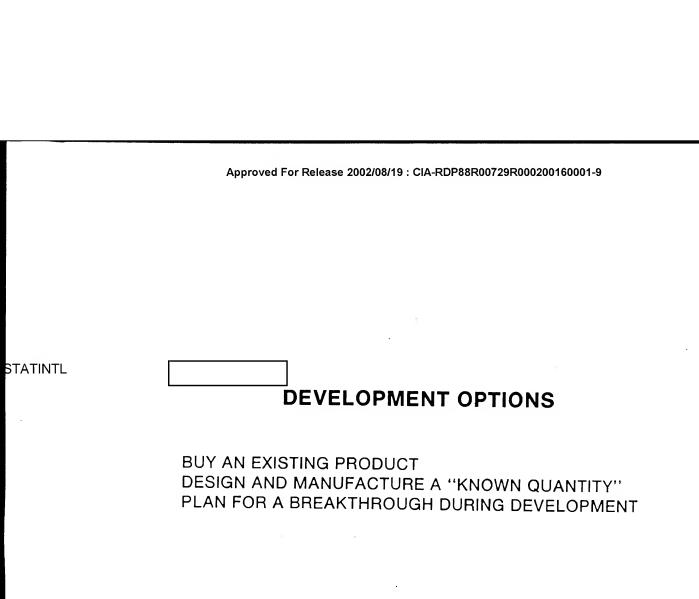
Mission Urgency

CONTINGENCIES

Requirements Growth or Change

Technical Risk

Staffing Delays



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STATINTL

CONTRACT OPTIONS

"TYPE"
DELIVERABLES
DURATION AND SCHEDULE
PAYMENT TERMS
PERFORMANCE
CLAUSES

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STATINTL

CHOOSING A CONTRACTOR

FIND QUALIFIED SOURCES
EXPLAIN YOUR PROBLEM AND NEED
COLLECT DATA FROM POTENTIAL CONTRACTORS
EVALUATE
NEGOTIATE
OBTAIN A CONTRACT
GO TO WORK!

STATINTL

MANAGING THE DEVELOPMENT PROCESS

ROLES

REQUIREMENTS MANAGEMENT COST CONTROL SCHEDULE MANAGEMENT TECHNICAL RISK MANAGEMENT

TOOLS

CONFIGURATION MANAGEMENT FINANCIAL REPORTS AND EVALUATION SCHEDULE TRACKING SYSTEMS TECHNICAL AUDITS AND REVIEWS

STATINTL

BUYING AND SELLING THE PRODUCT

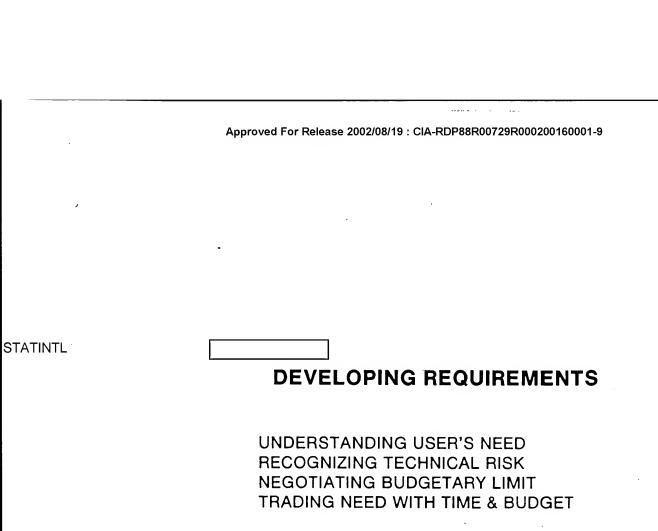
BUYING

TESTING EVALUATION AUDITS

SELLING

BELIEVING EDUCATING CONVINCING TRAINING

STATINTL **COTR Activities** terface Develop Control & Assure Requirements "Sell" Coordinate Adopt ith Users Acquisition The System System Plan Architecture Monitor Budgets & Schedules iterpret Synthesize lanagement Alternatives Resolve Interface Conflicts Manage New riorities Manage Requirements Analyses **Aonitor** Support & Defend Budget Capabilities Evaluate Industry Feasibility Manage Design Reviews Trade **\$vs** Perf **Monitor Progress** Manage Competitive **Buy Off on Products** Design Studies - Evaluate Test Results - Perform Audits Develop - Spec - Conops - IÇD's Concept Spec Prelim. Critical Prod. Install & Operations Fuzzy Problem Alloc. Definition Design Design & Test Integrate Notion Statement & Analysis Competitive Contractual



STATINTL

DEFINING GOOD REQUIREMENTS

DECOMPOSE

WHAT ARE MY AIMS?
WHAT ARE SOME MEASURABLE GOALS?
WHAT OBJECTIVES MUST BE MET ALONG THE WAY TO THE GOALS?
WHAT EXISTS?
WHAT'S MISSING?

IDENTIFY LIMITING FACTORS

COST TECHNOLOGY INSTITUTIONAL PERSONNEL

STATINTL

PREPARING A CONTRACT

EVALUATE TECHNICAL RISK
FORMULATE FEE-BASIS RECOMMENDATION
ESTABLISH FEE SCHEDULE
DEFINE DELIVERABLES AND SCHEDULE
ESTABLISH REPORTING AND DOCUMENTATION REQUIREMENTS
COORDINATE WITH SECURITY, LOGISTICS, TRAINING, & FINANCE

Approved For Release 2002/08/19: CIA-RDP88R00729R000200160001-9 STATINTL **QUALIFYING POTENTIAL CONTRACTORS** INDUSTRY CONTACTS & PROFESSIONAL SOCIETIES **QUALIFICATION BRIEFINGS BIDDERS CONFERENCE**

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STATINTL

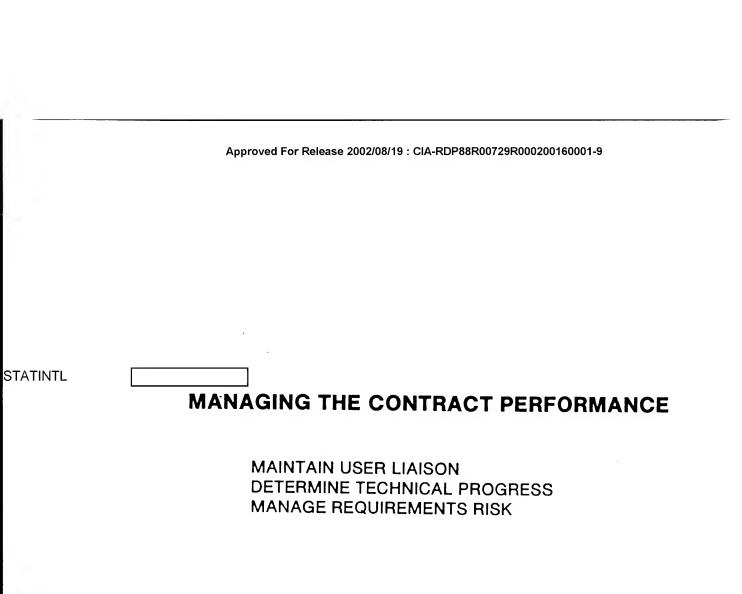
CHOOSING A CONTRACTOR

CONSULTANTS

SYSTEMS

STUDIES & ANALYSIS

SPECIALTY DEVELOPMENTS



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CONTROLLING COST & SCHEDULE

ACTIVELY MANAGE CRITICAL PATH ELEMENTS MINIMIZE WASTED EFFORT ASSURE CLOSURE OF INTERFACES CONFIRMING ACTUAL PROGRESS

STATINTL

ADMINISTERING COMPLIANCE

SECURITY
GOVT. PROPERTY
REPORTING

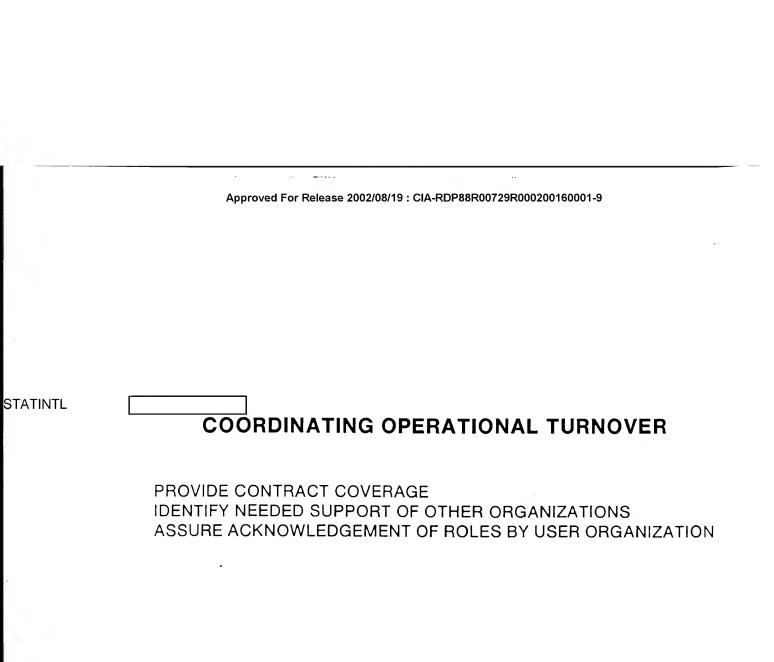
Approved For Release 2002/08/19: CIA-RDP88R00729R000200160001-9 STATINTL MINIMIZING TECHNICAL RISK **ENCOURAGE EARLY PROTOTYPING** DEMAND OPTIONS FOR CRITICAL ITEMS

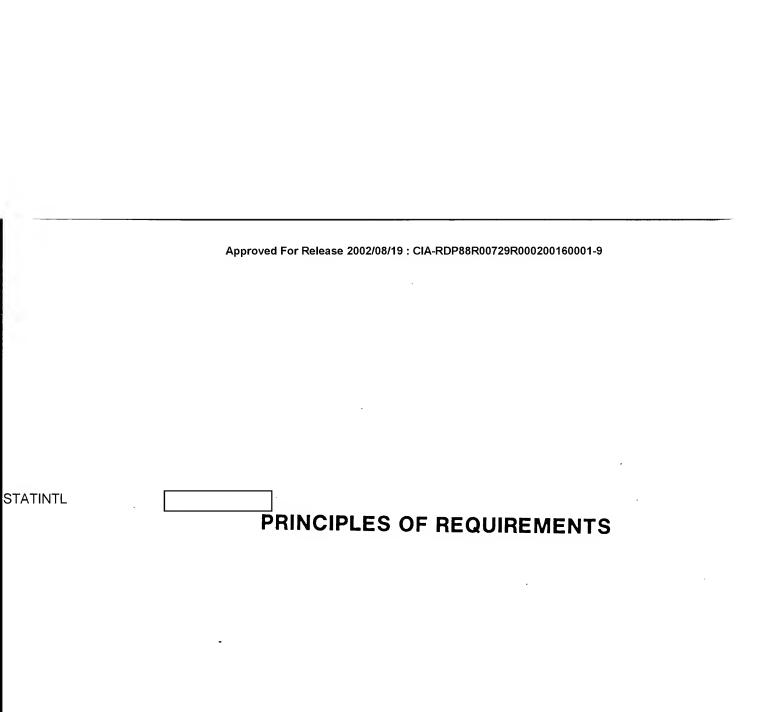
SEEK BACKUP SOURCES MANAGE REQUIREMENTS

STATINTL

ACCEPTING THE END PRODUCT

AGREE TO TEST PLAN COORDINATE USER INVOLVEMENT REVIEW TEST RESULTS AUDIT DELIVERIES





STATINTL

WHAT CONSTITUTES A REQUIREMENT?

CAPABILITIES

FUNCTIONALITY
MEASURABLE PERFORMANCE
BOUNDARY CONDITIONS

PROBLEM RESOLUTION

THREATS
DISRUPTION
DISFUNCTION
OPERATING COSTS

COST CAP

DEVELOPMENT OPERATING ANNUAL

OPERATIONAL DATE

INITIAL CAPABILITY

COMPLETE CAPABILITY
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STATINTL

PROPERTIES OF REQUIREMENTS

COMPLETE

SCOPE OF NEED LIFE CYCLE SUPPORT PERFORMANCE

CLEAR

TERMS DEFINED SIMPLE STATEMENTS

UNAMBIGUOUS

SIMPLE CONDITIONS SPECIFIC

TESTABLE

EXPLICIT
STIPULATED ENVIRONMENT
KNOWN INTERFACES
PREDICTABLE BEHAVIOR

STATINTL

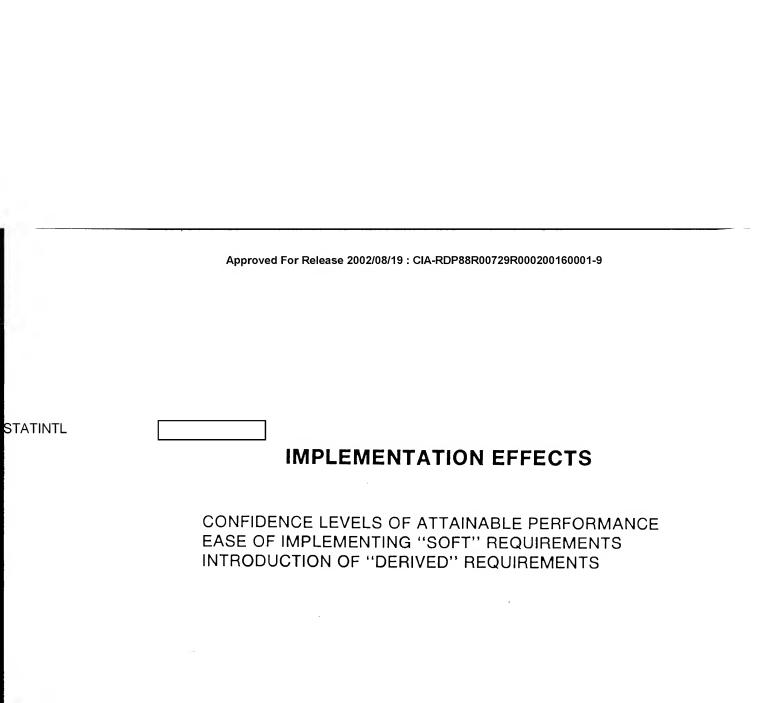
REQUIREMENTS vs SPECIFICATIONS

REQUIREMENT

PROVIDE STANDARD ARITHMETIC OPERATIONS FOR AT LEAST TWO YEARS IN A SHIRT-POCKET SIZE TO 8 DIGIT ACCURACY

SPECIFICATION

PERFORM ADDITION, SUBTRACTION, MULTIPLICATION & DIVISION MTBF = 3 YRS EXCEPT POWER; FIELD REPLACEABLE BATTERIES, MTTR = 20 MIN 3 x 5 x 1/4 in. PACKAGE 10 PLACE FIXED POINT DISPLAY, 12 DIGIT INTERNAL ACCURACY



STATINTL

DISCIPLINES USED TO DEVELOP REQUIREMENTS

INQUIRY

DESCRIPTION OF OPERATIONAL PROBLEM DEFINITION OF TERMS FACT FINDING OF USER NEEDS

ANALYSIS

SIMULATION SENSITIVITY ANALYSES PERFORMANCE LIMITS

TRADE-OFF STUDIES

COST-PERFORMANCE TRADES CAPABILITY vs DEVELOPMENT TIME RISK vs MERITS

STATINTL

DEFINING GOOD REQUIREMENTS (continued)

DECOMPOSE

WHAT ARE MY AIMS?
WHAT ARE SOME MEASURABLE GOALS?
WHAT OBJECTIVES MUST BE MET ALONG THE WAY TO THE GOALS?
WHAT EXISTS?
WHAT'S MISSING?

IDENTIFY LIMITING FACTORS

COST TECHNOLOGY INSTITUTIONAL PERSONNEL

STATINTL

DEFINING GOOD REQUIREMENTS (continued)

DEFINE THE RULES

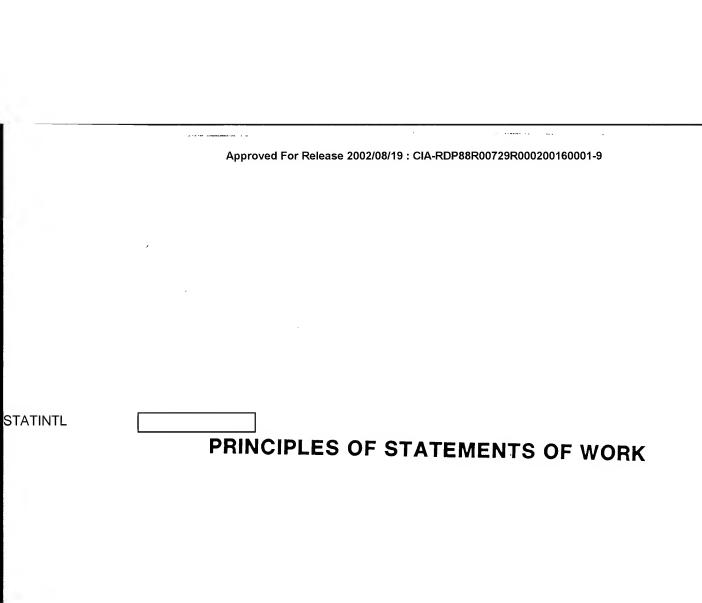
LEGAL POLICY TRADITION

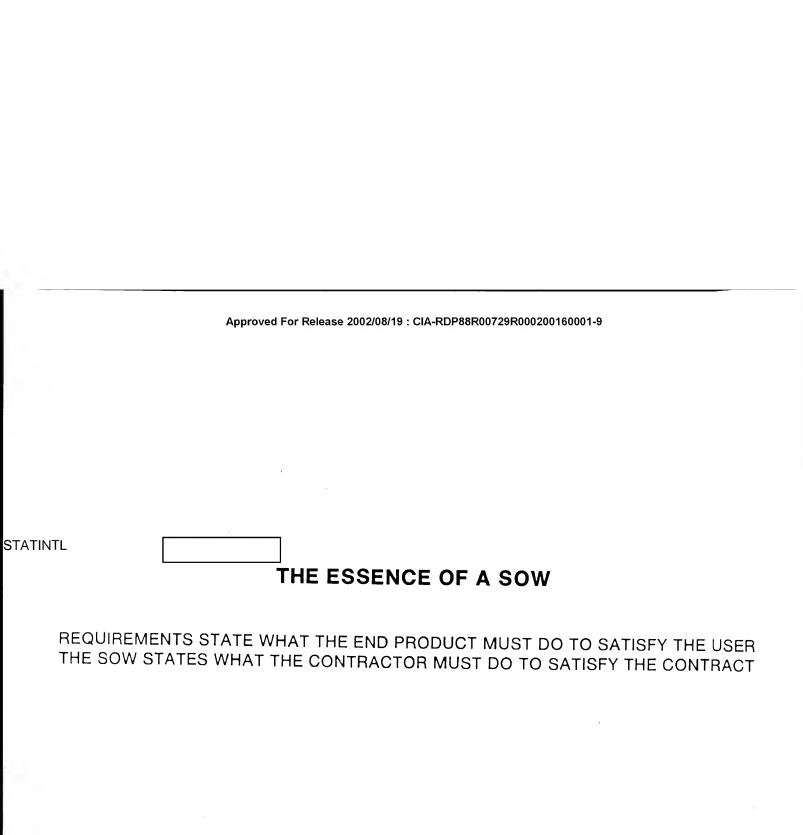
ADOPT DIFFERENT VIEWPOINTS

USERS BUILDERS FUNDERS

CONSIDER THE CONSEQUENCES?

IMMEDIATE NEAR TERM FAR TERM





STATINTL

PRODUCT ORIENTED SOW

THE PRODUCT MUST:

MOVE
SENSE
COMPUTE
PROTECT
FUNCTION RELIABLY
BE COMPATIBLE WITH A DEFINED OPERATIONAL ENVIRONMENT

STATINTL

PRODUCT ORIENTED SOW

THE PRODUCT MUST:

MOVE
SENSE
COMPUTE
PROTECT
FUNCTION RELIABLY
BE COMPATIBLE WITH A DEFINED OPERATIONAL ENVIRONMENT

STATINTL

PRODUCT ORIENTED SOW (continued)

THE CONTRACTOR MUST:

DERIVE SPECIFICATIONS
DOCUMENT DEVELOPMENT REQUIREMENTS
DESIGN THE PRODUCT
PRODUCE AND MAINTAIN DRAWINGS & PRODUCT SPECS
HOLD DESIGN REVIEWS
PROVIDE A PRODUCTION FACILITY
BUILD THE PRODUCT
MAINTAIN QUALITY CONTROL
MAINTAIN CONFIGURATION CONTROL
TEST THE PRODUCT
PRODUCE USER AND MAINTENANCE MANUALS
PROVIDE TRAINING
DELIVER AND INSTALL THE PRODUCT
PRODUCE PERIODIC COST AND TECHNICAL PROGRESS REPORTS

STATINTL

R&D ORIENTED SOW

THE PRODUCT MUST:

DEFINE LIMITS
ESTABLISH COST-PERFORMANCE OPTIONS
ESTABLISH FEASIBILITY

THE CONTRACTOR MUST:

PERFORM ANALYSES
CONSTRUCT A WORKING MODEL
CONDUCT EXPERIMENTS
DOCUMENT RESULTS
PROJECT FUTURE PERFORMANCE
CONDUCT BRIEFINGS

STATINTL

STUDY ORIENTED SOW

THE PRODUCT MUST:

ILLUMINATE A PROBLEM DEFINE AND EVALUATE OPTIONS ANALYTICALLY ESTABLISH BEHAVIOR

THE CONTRACTOR MUST:

OBTAIN DATA
DEVELOP MODELS
CONDUCT ANALYSES
EVALUATE RESULTS
HOLD MEETINGS
DOCUMENT RESULTS
CONDUCT A MID-TERM & FINAL BRIEFING

STATINTL

THE COST CONNECTION OF THE SOW

PRODUCT COSTS:

FUNCTION
PERFORMANCE
QUANTITY
QUALITY

PROCESS COSTS:

TASKS

DESIGN TEST TRAINING

DOCUMENTATION

SPECS
DRAWINGS
PLANS & PROCEDURES
FIN 'NCIAL REPORTS
SCHEDULE PROJECTIONS

EXTERNAL COORDINATION

USER INTERFACES TECHNICAL INTERFACES INFORMATIVE BRIEFINGS

STATINTL

THE COST CONNECTION OF THE SOW (continued)

WORK BREAKDOWN STRUCTURE:

PRODUCT CONNECTED TASKS:

PRODUCT SPECS
PRODUCTION
UNIT TEST

PROCESS MANDATED TASKS:

SYSTEMS ENGINEERING
QUALITY CONTROL
SYSTEM TEST
CONFIGURATION MANAGEMENT
FINANCIAL & SCHEDULE CONTROLS

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STATINTL	
	SOW CHECKLIST

DEFINES ONLY THAT WHICH IS NECESSARY FOR THIS CONTRACT

GENERAL INFORMATION IS SEPARATED FROM DIRECTION CONTRACTOR OBLIGATIONS ARE CLEAR AND DIRECT ELIMINATES EXTRANEOUS DATA REQUIREMENTS

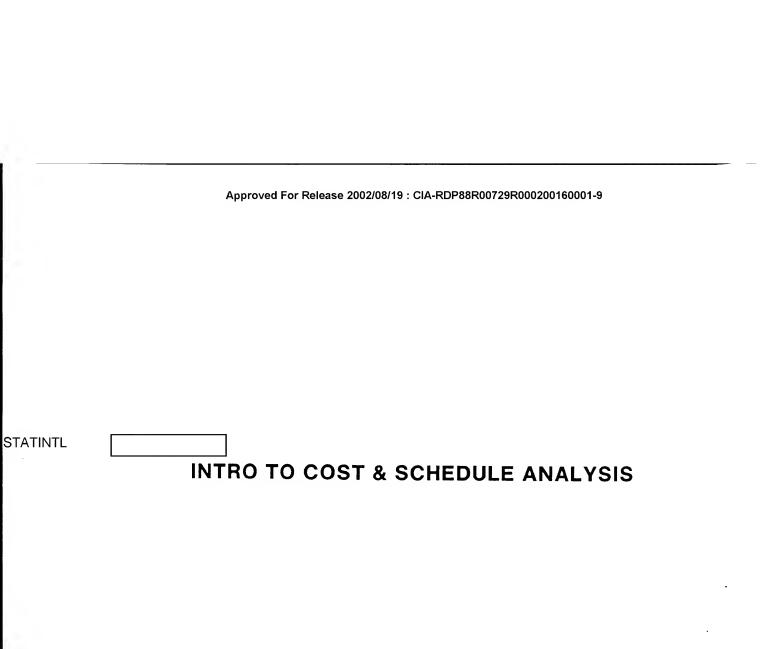
TELLS THE CONTRACTOR WHAT HE MUST DO, NOT HOW TO DO IT

SUFFICIENTLY SPECIFIC TO ALLOW RESOURCES TO BE LISTED STIPULATES DELIVERABLES, QUANTITIES & DATES

REFLECTS THE MANAGEMENT CONCEPT FOR EXECUTION OF THE CONTRACT

CONSISTENT WITH CONTRACT DATA REQUIREMENTS LIST (CDRL)
REFERENCED CITATIONS ARE CHECKED FOR PERTINENCE

REQUIRES THE MINIMUM CHANGE TO THE CONTRACTOR'S NORMAL PRACTICES



STATINTL

STAGES IN COST & SCHEDULE ANALYSIS

IDENTIFY PRODUCT ELEMENTS
DEFINE TASKS TO PRODUCE EACH
DETERMINE COST ELEMENTS
DERIVE COST ESTIMATION RELATIONSHIPS
DETERMINE SCHEDULE CONNECTIONS & CONSTRAINTS
MINIMIZE COST-RISK TRADE-OFF

STATINTL

COST ELEMENTS

DIRECT COSTS

LABOR
EQUIPMENT
MATERIALS
PURCHASED ITEMS
TRAVEL
SHIPPING

STATINTL



COST ELEMENTS (continued)

INDIRECT COSTS

HOLIDAYS & VACATION PAY
INSURANCE
UTILITIES
SECURITY
PAYROLL & ACCOUNTING
GENERAL PURPOSE RESEARCH FACILITIES
BID & PROPOSAL BUDGETS
INDEPENDENT RESEARCH & DEVELOPMENT

FEE

EARNED VALUE
DELIVERED PRODUCTS

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TASK DEFINITIONS

KEYED TO END PRODUCTS & DELIVERABLES
SUPPORT INTERNAL MILESTONES
HIERARCHICAL WORK STRUCTURE TO MEET MILESTONES
DEFINES A WINDOW INTO THE SMALLEST UNIT OF PRODUCTION

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SCHEDULE CONSTRAINTS

RESOURCE LEVELS
PRECEDENT TASK DEPENDENCY

PRECEDENT TASK DEPENDENCY
USE OF SHARED FACILITIES
CALENDAR DRIVEN MILESTONES
EXTERNALLY DEFINED INTERFACES

STATINTL

SCHEDULING CONCEPTS

MINIMUM TIME PATH
MINIMUM COST PATH
MAXIMUM (MINIMUM SLACK) PATH
LOAD LEVELING
EARLIEST VS LATEST START DATE

STATINTL

SCHEDULING ALGORITHMS

FORWARD SCHEDULING

RESOURCE AVAILABILITY TASK DEPENDENCIES LOAD LEVELING

BACKWARD SCHEDULING

NEED DATES SLACK MANAGEMENT

STATINTL

COST-SCHEDULE TRADES

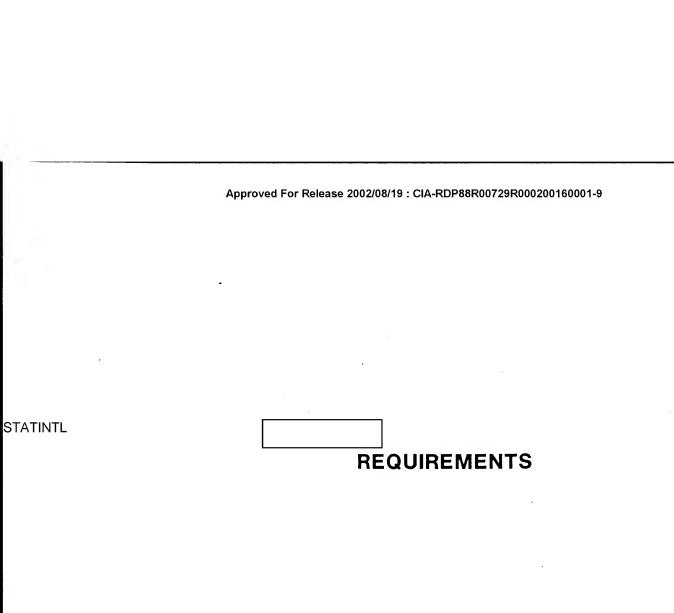
OVERTIME PAY
OVERHEAD STRETCH-OUT
LEARNING CURVE EFFECTS
PRODUCTION LINE LIMITS
FIXED FACILITY CHOKEPOINTS

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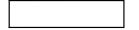
.
STATINTL

LIFECYCLE FACTORS

MAINTENANCE SUPPLIES RECURRING TRAINING OPERATIONAL MODIFICATIONS



STATINTL



EVOLVING DETAIL

NEEDS (USER/systems engineer)

IDEAL GOALS
MISSION ORIENTED
TEST: MUST MAKE OPERATIONAL SENSE

REQUIREMENTS (USER/SYSTEMS ENGINEER)

PERFORMANCE GOALS
MIX OF MISSION, ARCHITECTURE, AND FUNCTION
TEST: MUST BE FEASIBLE

SPECIFICATIONS (user/SYSTEMS ENGINEER)

MEASURABLE PROPERTIES EQUIPMENT & FUNCTIONS TEST: MUST BE PROVABLE

STATINTL

INTERFACE SPECIFICATIONS

HARDWARE

PACKAGING CONSTRAINTS
PHYSICAL INTERFACES
ELECTRICAL INTERFACES
COMPUTERS
CONSTRAINTS OR LIMITATIONS

SOFTWARE

OPERATING SYSTEM
UTILITY PROGRAMS
OTHER APPLICATION PROGRAMS
CONSTRAINTS OR LIMITATIONS

STATINTL

INTERFACE SPECIFICATIONS (continued)

COMMUNICATIONS

PROTOCOLS
PRIORITIES
TRAFFIC VOLUME
TIMELINESS

DATA

INPUT/OUTPUT INFORMATION QUANTITY TIMING

OPERATIONS

ORGANIZATIONAL ROLES PROCEDURES INTERACTIONS

STATINTL

DATA PROCESSING SYSTEMS

FUNCTIONS AND OPERATING MODES
INITIALIZATION
WORKLOAD THROUGHPUT & PEAKS
DATA CHARACTERISTICS & VOLUME
STIMULI AND RESPONSES
STORAGE/RETRIEVAL VOLUMES & TIMELINES
ACCURACY
INPUT/OUTPUT OPTIONS AND LOADS
DECISION AND CONTROL OPTIONS
ERROR DETECTION & RECOVERY
HUMAN FACTORS
DESIGN MARGINS
AVAILABILITY

STATINTL

SENSOR SYSTEMS

SIGNATURE ENVIRONMENT
BACKGROUND ENVIRONMENT
DETECTION VOLUME
PROBABILITY OF DETECTION
FALSE ALARM RATE
FAILURE DETECTION & RECOVERY
BUILT-IN TEST
AVAILABILITY
OPERATING LIFE
PACKAGING LIMITS
SUPPORT LIMITS (POWER, TEMP CONTROL, ETC)

STATINTL

MECHANICAL SYSTEMS

EXTERNAL LOADS
FUNCTIONS
ACCURACY/TOLERANCES
SAFETY
WEAR LIMITS
MOTION CONSTRAINTS
OPERATING ENVIRONMENTS
OPERATING LIFE
AVAILABILITY
MEAN-TIME-BEFORE-FAILURE & MEAN-TIME-TO-REPAIR

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STATINTL

PERFORMANCE vs "...ILITIES"

ENVIRONMENTAL DESCRIPTION

BACKGROUND ENVIRONMENT EXTERNAL LOADS OPERATING ENVIRONMENTS

PERFORMANCE

MISSION UTILITY ERROR ANALYSIS ACCURACY/TOLERANCES

STATINTL

VARYING LEVELS OF PRESUMED THREAT LEVELS

TIMELINESS

SYSTEM SIMULATION UNDER LOAD MAN/MACHINE TRADE-OFFS COST/COMPUTER POWER TRADE-OFFS REACTION TIME

ROBUSTNESS

PHYSICAL SURVIVABILITY ADAPTABILITY TRANSPORTABILITY CONTROL OPTIONS

ACTIVITY LEVELS

MISSION AND OPERATIONS ANALYSES ENVIRONMENTAL DESCRIPTION

STATINTL

MANNED vs UNMANNED SYSTEMS

DECISION ANALYSIS

DECISION SEQUENCES INFORMATION REQUIREMENTS ERROR EFFECTS

WORK LOAD ANALYSIS

CONTENT LEVEL INTERFACES

HUMAN FACTORS STUDIES

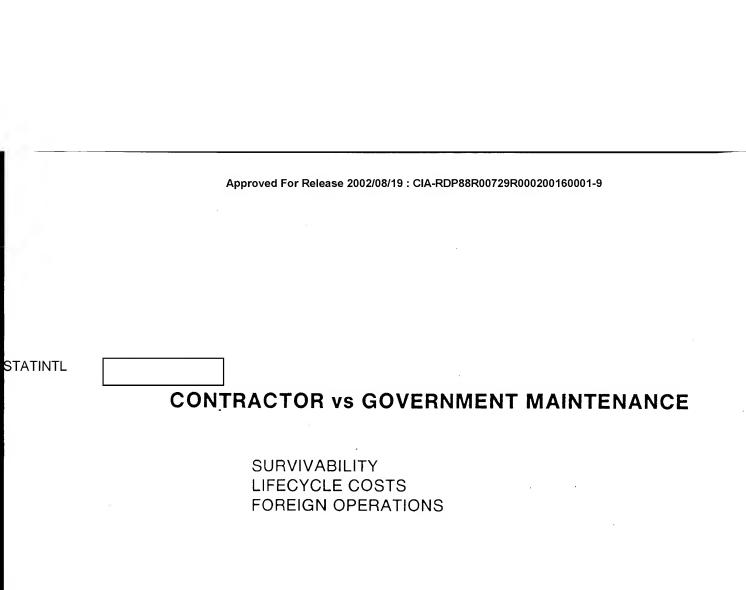
PHYSICAL RESPONSE STRESS RESPONSE TRAINING

SAFETY

STATINTL

FACTORY vs FIELD CALIBRATION

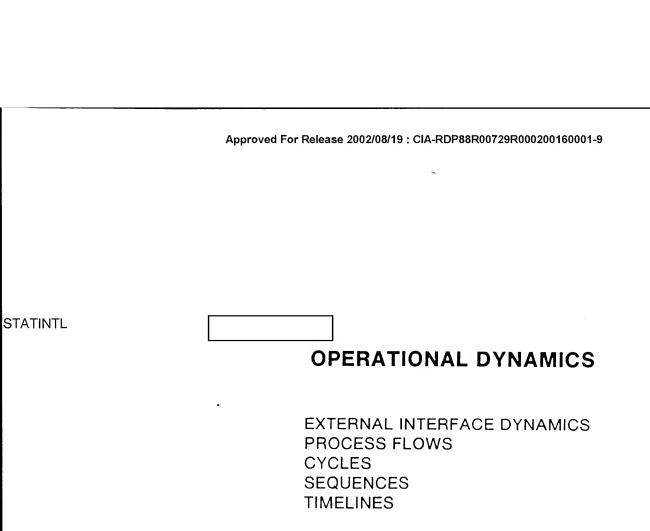
RELIABILITY
MAINTAINABILITY
ERROR DETECTION & RECOVERY
SURVIVABILITY



STATINTL

SCOPE OF DEFINITION

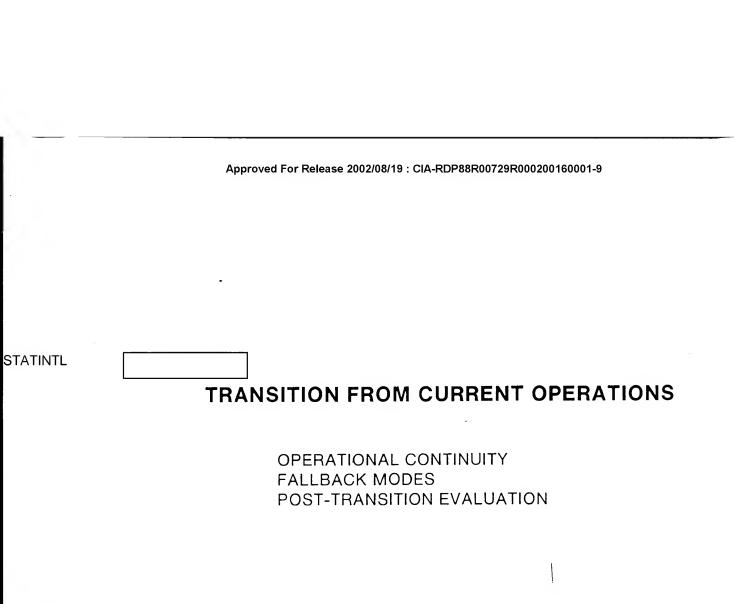
Transition from Current Operations
Operational Organizational Roles
Support Organization Roles
Training
Maintenance
End-of-Life Disposal



STATINTL

OPERATIONAL THEMES

DATA ENVIRONMENT THREAT ENVIRONMENTS LOGISTIC ENVIRONMENTS PERSONNEL CONTROL CRITERIA PERFORMANCE LEVELS



STATINTL



ROLES

DEFINE PROBLEMS
DEVELOP STRATEGY
STRUCTURE APPROACH
MAKE DECISIONS
EVALUATE RESULTS

CONSTRAINTS ON THE ROLE

SPAN OF CONTROL IN OPERATIONS UNDERSTANDING OF THE SYSTEM INFORMATION SOURCES & CONTENT

REQUIREMENTS IMPACT

PERFORMANCE ASSESSMENT OPERATIONAL FLEXIBILITY USER-ORIENTED TRAINING

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STATINTL

OPERATORS ("PHYSICAL USER")

ROLES

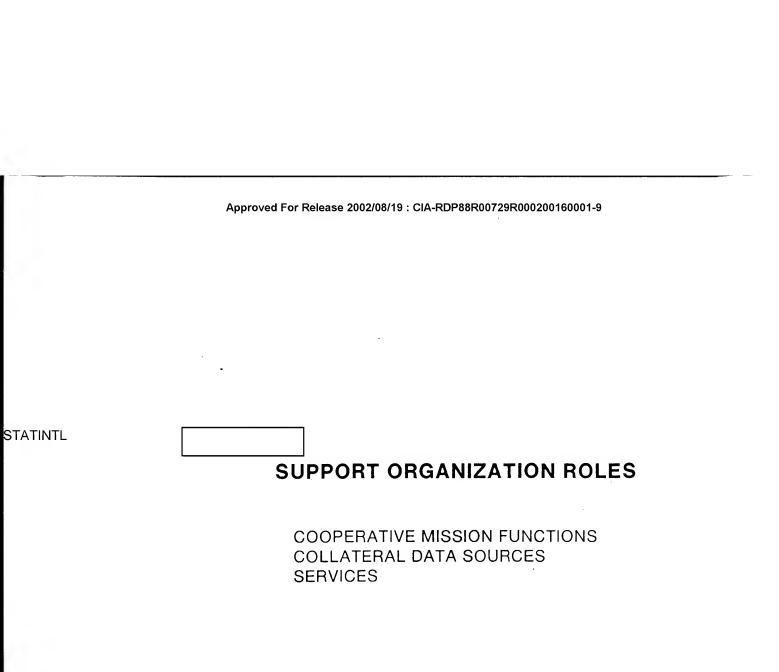
ENTER DATA
CALIBRATE EQUIPMENT
PERFORM TEST PROCEDURES
MANIPULATE DEVICES
VALIDATE RESULTS
RESPOND TO ERRORS

CONSTRAINTS ON THE ROLE

EXPERIENCE
EDUCATION LEVEL
PHYSICAL CAPABILITIES
OPERATING ENVIRONMENT

REQUIREMENTS IMPACT

DECISION OR REACTION TIME
ERROR EFFECTS ON MISSION
SAFETY & SECURITY RISKS
TRAINING TIME & COSTS
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STATINTL



MODES

INITIAL RECURRING QUICK REACTION

AUDIENCES

USERS OPERATORS MAINTENANCE

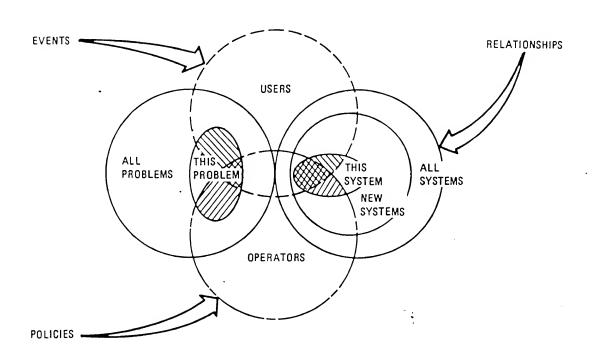
STATINTL

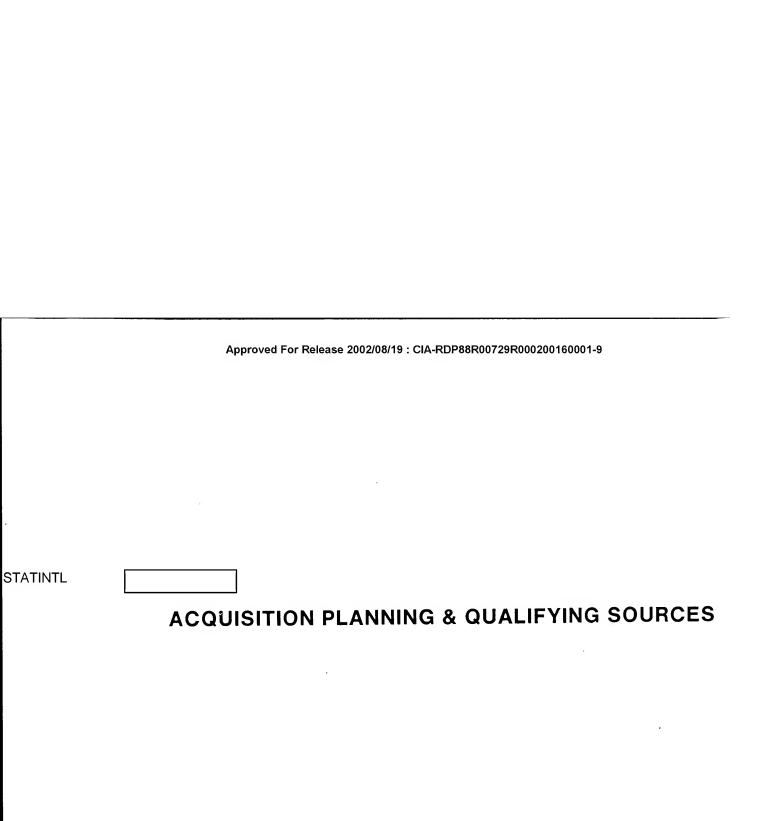
PREVENTATIVE
ON-DEMAND
REPLACEMENT PARTS
CONSUMABLE SUPPLIES

STATINTL



The Operational Environment





STATINTL

ACQUISITION PARAMETERS AND THEIR INFLUENCE

SIZE

NUMBER OF CONTRACTS MANAGEMENT STRUCTURE

RISK

SCHEDULE BUDGET TYPE OF CONTRACT Approved For Release 2002/08/19 : CIA-RDP88R00729R000200160001-9

STATINTL

CONTRACTING STRUCTURE

COMPETITIVE vs SOLE SOURCE
MULTIPLE CONTRACTS

MULTIPLE CONTRACTS
DIVIDING A JOB
AUXILIARY SUPPORT CONTRACTS
SYSTEM INTEGRATION
INDEPENDENT TEST

STATINTL

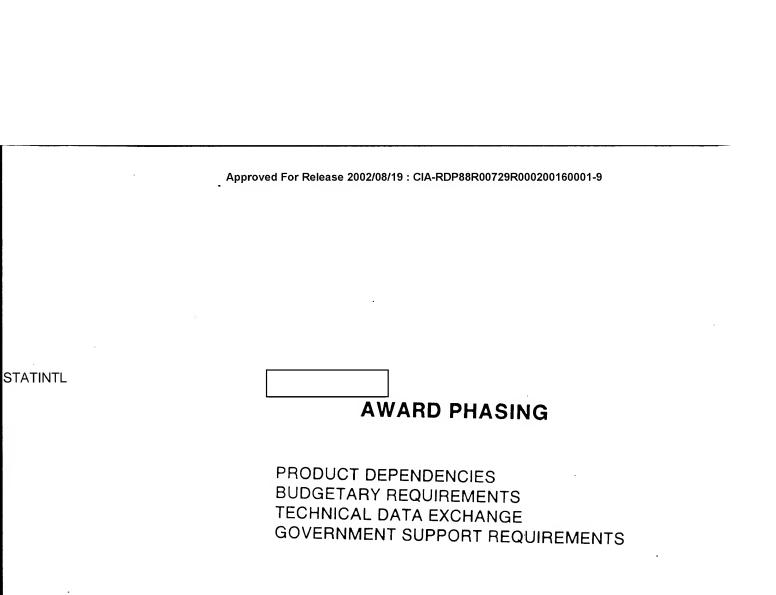
CONTRACTUAL PACKAGING

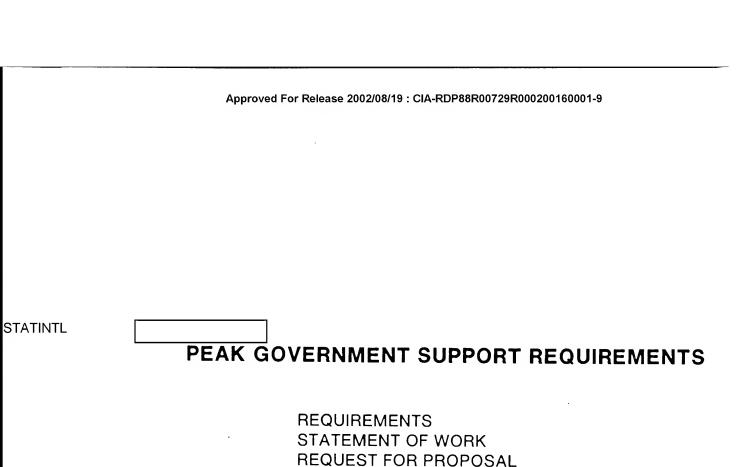
DESIGN FACTORS

INTERFACE SIMPLICITY TESTABILITY

MANAGEMENT FACTORS

INDUSTRY SPECIALIZATION
SCHEDULE
ACCOUNTABILITY
INTERDEPENDENCES
SECURITY





PROPOSAL EVALUATION SPECIFICATION REVIEW

DESIGN REVIEW

TESTING

STATINTL

PROCUREMENT

Market Survey
Request for Proposals
Proposal Evaluation
Contracting

STATINTL

MARKET SURVEYS

Critical Skills
Security & Foreign Ownership/Control
Financial Stability
Specialized Facilities
Manpower
Past Performance (CONIF)

STATINTL

REQUEST FOR PROPOSALS

STATEMENT OF WORK

TASKS
DELIVERABLES
SCHEDULE
SYSTEM DESCRIPTION

PRODUCT REQUIREMENTS
CONTRACT DOCUMENT APPROVAL
DATA REQUIREMENTS DOCUMENT
WORK BREAKDOWN STRUCTURE
INCENTIVE OPTIONS
PROPOSAL ORGANIZATION REQUIREMENTS
PROPOSAL EVALUATION GUIDES

STATINTL

TECHNICAL PROPOSAL CONTENTS

DESIGN CONCEPT

HARDWARE SOFTWARE DATA OPERATIONAL PROCEDURES TRAINING MAINTENANCE

CRITICAL PROBLEMS

DIFFICULT REQUIREMENTS IMMATURE TECHNOLOGY STRESSFUL ENVIRONMENT UNUSUAL LOGISTIC NEEDS PACKAGING

STATINTL

TECHNICAL PROPOSAL CONTENTS (continued)

TRADE-OFF OPPORTUNITIES

CONFLICTING REQUIREMENTS
COST-EFFECTIVE ENHANCEMENTS
DEVELOPMENT COST vs RECURRING COSTS

DEVELOPMENT APPROACH

PROTOTYPES
BUILDS
PHASED DEPLOYMENTS

TEST APPROACH

TEST PHILOSOPHY
GOVERNMENT ROLE & DATA
SIMULATORS
TEST EQUIPMENT

SCHEDULE MANNING

STATINTL

MANAGEMENT PROPOSAL CONTENTS

Organization and Personnel
Technical and Financial Controls
Configuration and Data Management
Security Plan
Developement Support
Field Support
Integrated Logistics Support
Documentation Plan
Relevant Experience
Biographical Data
Proposal Linkage

STATINTL

COST PROPOSAL CONTENTS

ESTIMATING BASIS

TECHNICAL SIZING
PRODUCTION BASE
EXISTING FACILITIES, TOOLING, ETC

WORK BREAKDOWN STRUCTURE RATES

DIRECT LABOR OVERHEAD

RESULTS

PRODUCT RELATED BREAKOUT FISCAL YEAR SPREAD REQUIREMENTS BREAKOUT

EFFECTS OF UNCERTAINTIES

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STATINTL

PROPOSAL EVALUATION GUIDES

FORCE EARLY RECOGNITION OF CRITICAL ISSUES

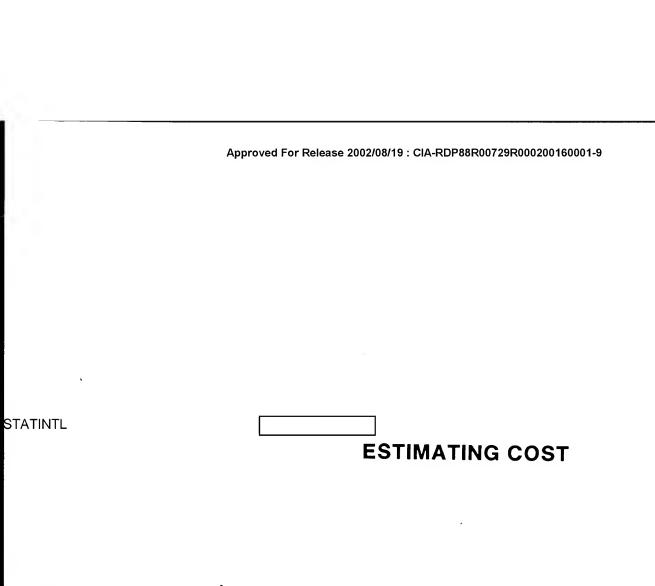
KEY DESIGN TRADE-OFFS STATE-OF-ART UNCERTAINTIES RAPID MANNING REQUIRED FAMILY SEPARATIONS UNCONTROLLED INTERFACES

STIMULATE THE DESIRED BALANCE

TECHNICAL/MANAGEMENT/COST DESIGN/TEST/OPERATIONS ARCHITECTURE-SPECIFIC ELEMENTS

PROMOTE COMPETITION

ENCOURAGE RESPONSES
INCREASE ACCEPTABLE RESPONSES
IMPROVE CONTRACTOR'S UNDERSTANDING OF PRIORITIES



STATINTL

COST ESTIMATION

TOTAL EFFORT

PROJECT SCALE COMPLEXITY AVAILABLE TECHNOLOGY DELIVERY TIME

LOADING

CUMULATIVE EFFORT STAFF ABSORBTION RATE WORK DAY LENGTH Approved For Release 2002/08/19 : CIA-RDP88R00729R000200160001-9

STATINTL

COST ESTIMATING METHODS

DETAILED ESTIMATES
SCALED ANALOGS

PARAMETRIC MODELS SUBJECTIVE METHODS

STATINTL



DESCRIPTION

BASELINE DESCRIPTION OF WORK
CAPITAL EQUIPMENT & SCHEDULES
COSTING RATES AND FACTORS
WORK-BREAKDOWN-STRUCTURE ORIENTED
"LEARNING CURVES"

PROS/CONS

HIGHLY VISIBLE
GAINS COMMITMENT
COSTLY

STATINTL



DESCRIPTION

EXISTING SIMILAR SYSTEM
CAN BE SCALED PHYSICALLY OR
PROGRAMMATICALLY

PROS/CONS

HIGH CONFIDENCE BASELINE LIMITED EXTRAPOLATION

STATINTL

PARAMETRIC MODELS

DESCRIPTION

BASED ON EMPERICAL FIT TO HISTORICAL DATA
COST ELEMENT ORIENTED

COMPONENT BREAKDOWN
TECHNICAL, PHYSICAL OR
PERFORMANCE CHARACTERISTICS
PROGRAM TASKS (QUALITY CONTROL,
DOCUMENTATION, DESIGN)

PROS/CONS

MODELS PERMIT PARAMETRIC DESIGN
REPEATABLE
INTERCONNECTED EFFECTS
SCHEDULE SENSITIVE
DATA BASES MUST BE VALIDATED
MODELS MUST BE CALIBRATED
EXTRAPOLATION LIMITS SHOULD BE KNOWN

STATINTL

SUBJECTIVE METHODS

DESCRIPTION

EXPERT OPINION DELPHI W-A-G

PROS/CONS

ONLY TECHNIQUE USEFUL FOR NEW TECHNOLOGY FAST & CHEAP UNBOUNDED ERRORS

Approved For Release 2002/08/19: CIA-RDP88R00729R000200160001-9 **ESTABLISHING SCALING FACTORS**

STATINTL

EFFECTS OF SIZE TECHNOLOGY IMPROVEMENTS PRODUCTION TOOLS

STATINTL

FINDING THE DATA

INDUSTRY MODELS
CONTRACTED STUDIES
GOVERNMENT FILES

STATINTL

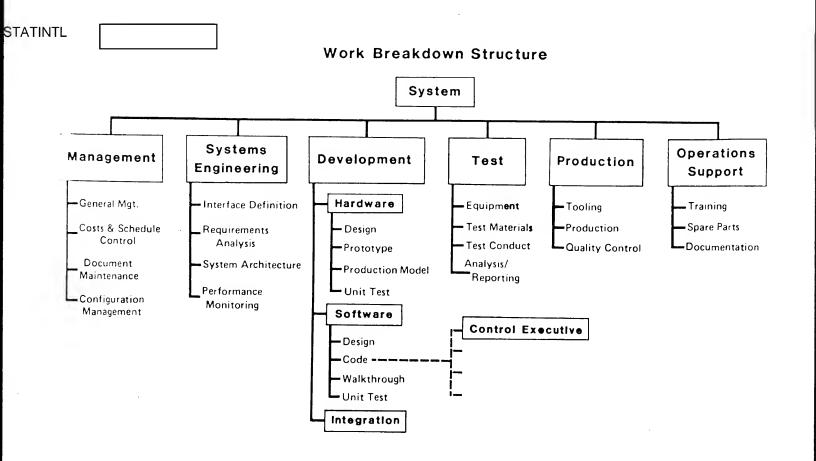
LOOKING BEHIND THE DATA

SHARED FACILITIES
GOVERNMENT FURNISHED ITEMS
PRODUCTIVITY OR EXPERIENCE
REQUIREMENTS CHANGES

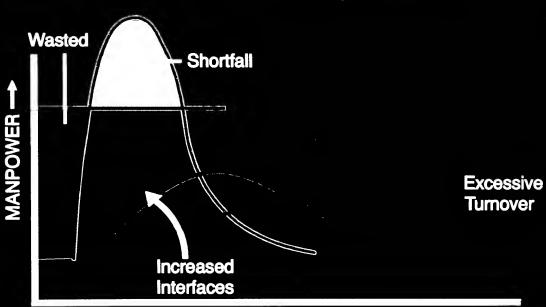
STATINTL

SCHEDULING FACTORS

STAFFING RATE POSSIBLE LEARNING ACCELERATION FACTOR INTERFACE COMPLEXITY RESOURCE BOTTLENECKS CONTRACT DEPENDENCIES







TIME ---

STATINTL

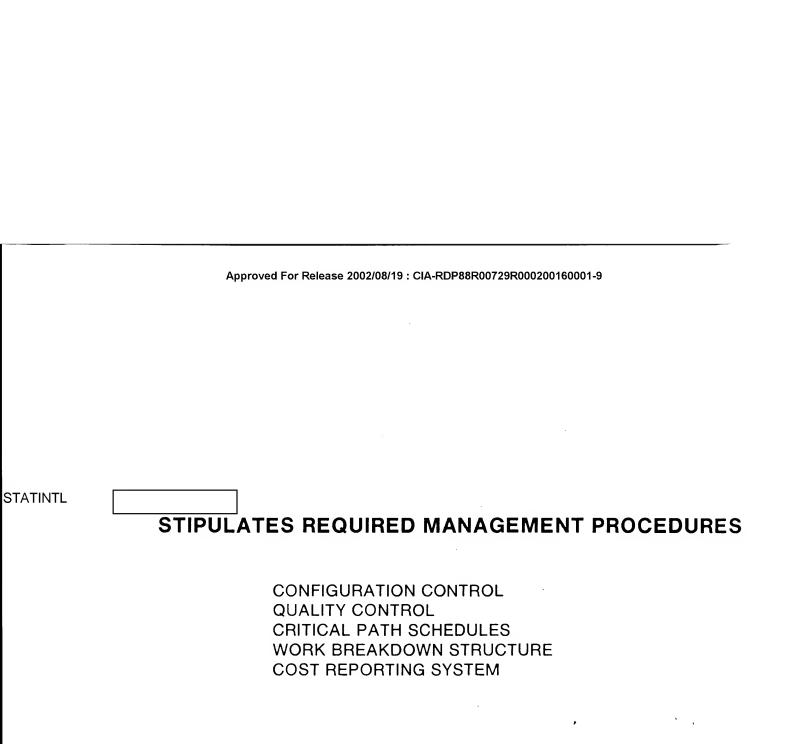
DEFINES SCOPE OF EFFORT

MANAGEMENT STUDIES DEVELOPMENT TESTING COORDINATION INTEGRATION MEETINGS TRAINING REVIEWS MAINTENANCE SUPPORT

STATINTL

TASK EXAMPLES

DEVELOP, TEST, AND DELIVER A SYSTEM WHICH MEETS
REQUIREMENTS SPEC
PROVIDE DOCUMENTATION PER MILSTD 490/483
PERFORM AN ACCURACY/RELIABILITY TRADEOFF STUDY
TRAIN 200 PERSONNEL AT 3 CONUS SITES
SHARE IN DEVELOPMENT OF INTERFACE SPECS
REVIEW & CRITIQUE OTHER CONTRACTOR'S TEST PLANS
PROVIDE A MONTHLY PROGRESS BRIEFING IN WASHINGTON



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STATINTL	
	IDENTIFIES OTHER APPLICABLE DOCUMENTS
	STANDARDS AND PRACTICES REGULATIONS
	LEGALLY REQUIRED PROGRAMS PRECEDENCE OF REQUIREMENTS

HIGHER LEVEL REQUIREMENT DOCUMENTS

INTERFACE DOCUMENTATION

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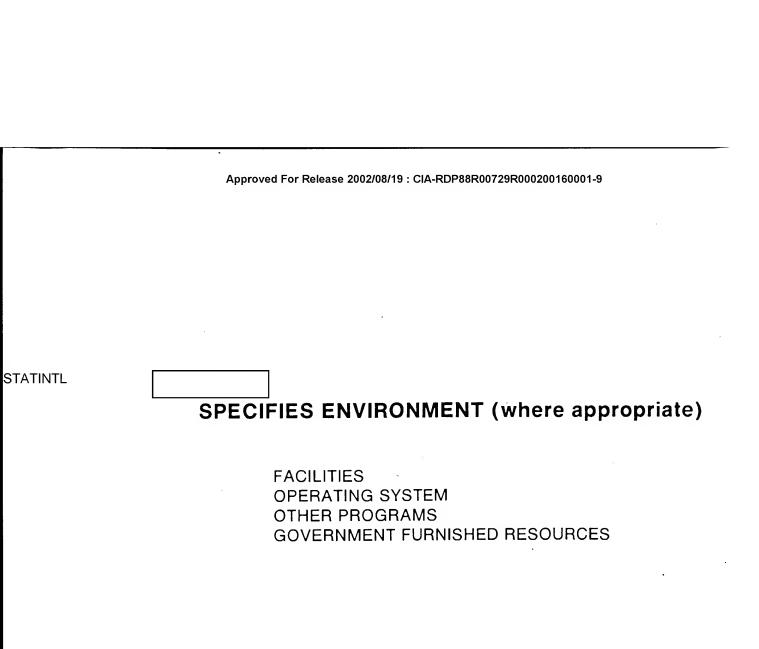
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STATINTL

IDENTIFIES DELIVERABLES AND SCHEDULE

DOCUMENTS
BRIEFINGS

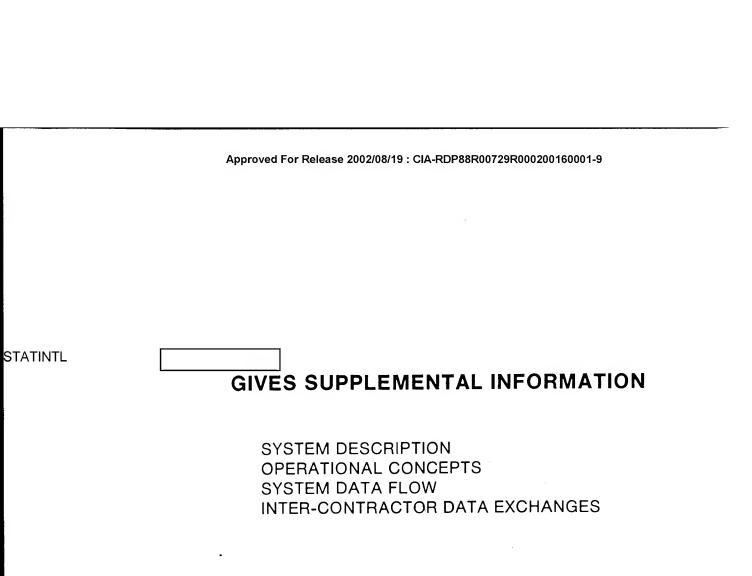
DESIGN REVIEWS STATUS MEETINGS END PRODUCTS



STATINTL

ESTABLISHES THE NEED FOR MINIMAL STANDARDS

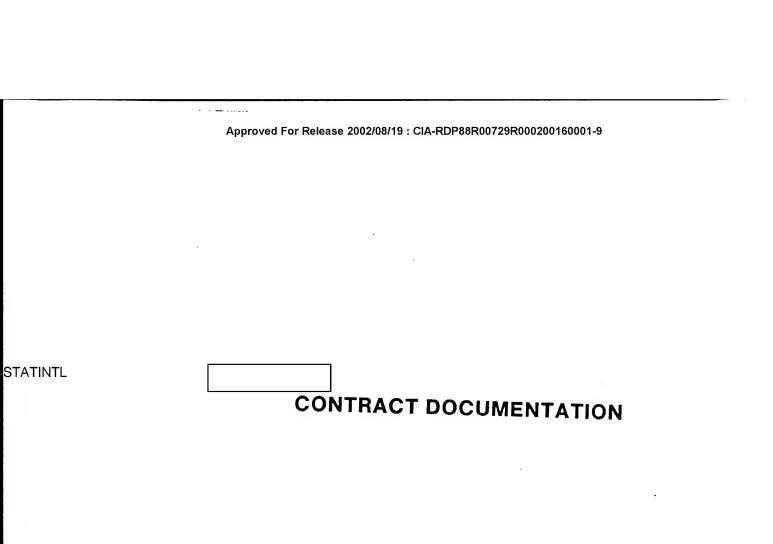
Programming Standards and Conventions
Design Standards
Testing and Quality Assurance
Safety Criteria
Physical & Personnel Security

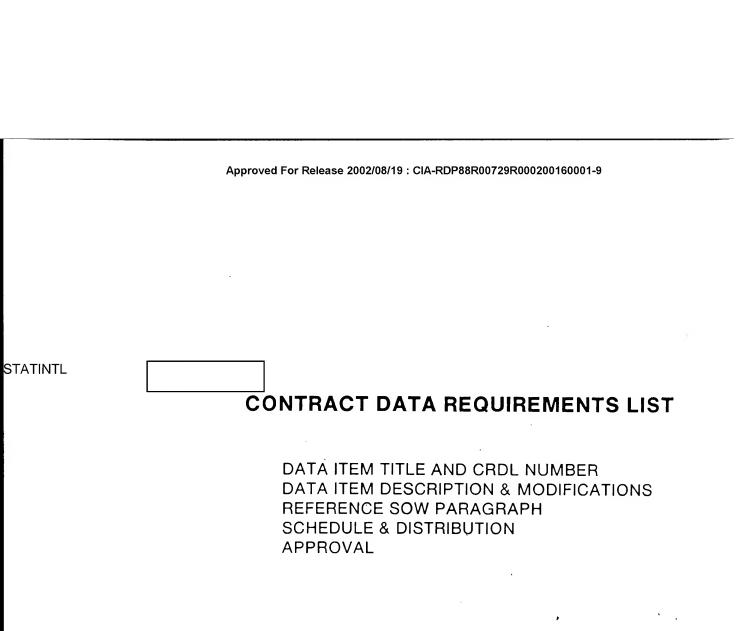


STATINTL

WORK WORD—EXAMPLES

ANALYZE—Solve by analysis
CONSIDER—Think about
DEVELOP—Bring into being
DEFINE—Make clear; Settle the limits
ESTIMATE—Approximate an opinion of
INSTALL—Place; Put into position
INSPECT—Examine carefully or officially
MANUFACTURE—Fabricate from raw materials
ORGANIZE—Integrate; Arrange in a coherent unit
PERFORM—Do; Carry out; Accomplish
RECOMMEND—Advise; Attract favor of
STUDY—Careful examination or analysis





STATINTL

CONTRACT DOCUMENT APPROVAL

PROVIDES BASELINE FOR DESIGN ENABLING AUTHORITY FOR INCENTIVE EVENTS FACILITATES ULTIMATE QUALITY CONTROL

REVIEW CYCLE MUST BE REALISTIC REVIEWERS MUST BE CRITICAL

PERMITS COORDINATION ACROSS CONTRACT INTERFACES

USER COMMUNITY REVIEW TECHNICAL INTERFACES

ASSURES THAT CONTRACTOR PRODUCES INTERNALLY REQUIRED DOCUMENTATION

STATINTL

DOCUMENTATION PURPOSES

STRUCTURE THE IMPLEMENTATION

ARCHITECTURE LOGIC DATA STRÚCTURE USAGE

GUIDE THE DEVELOPMENT PROJECT

PLANS STATUS TESTS COORDINATION

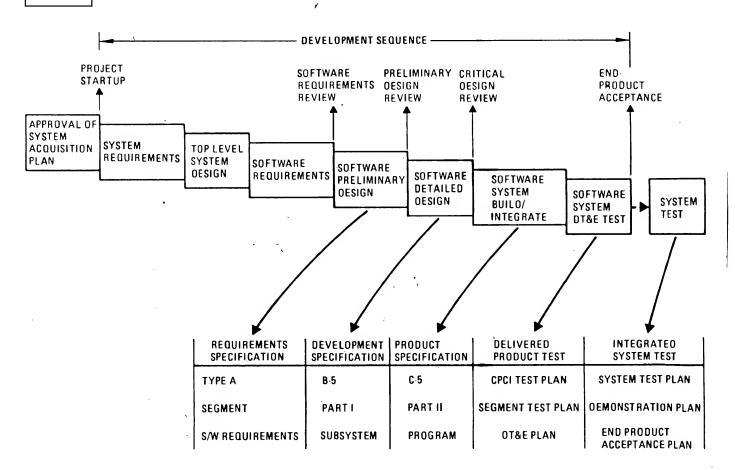
FACILITATE OPERATIONAL USAGE

INPUTS
STATUS
CHANGES
STUDIES
TRAINING
MAINTENANCE

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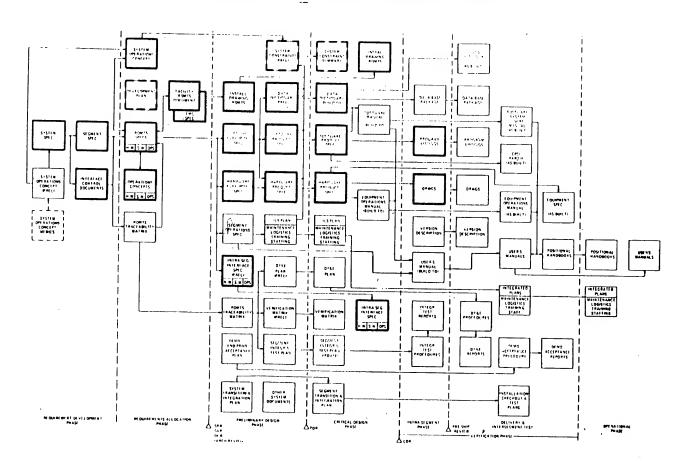
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The Software Document Maze



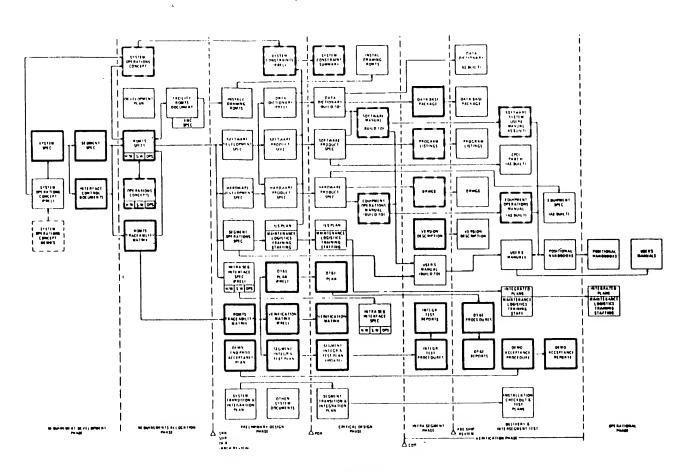
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Development Documents Flow



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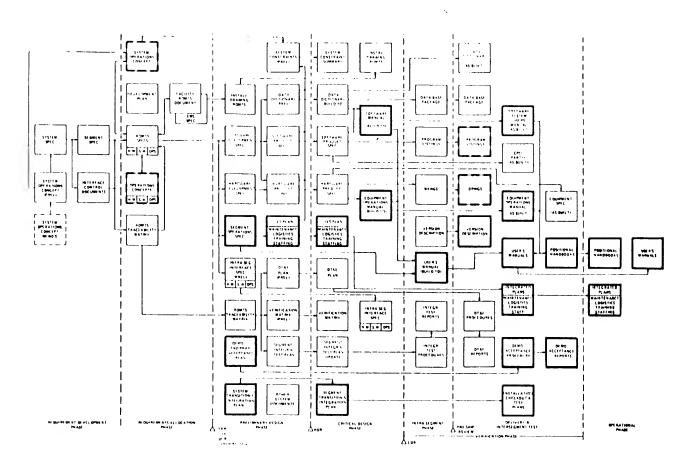
Verification Documents Flow



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Integration/Operational Documents Flow



STATINTL

PROJECT CONTROL DOCUMENTS

MANAGEMENT PLANS

ORGANIZATION STAFFING FINANCIAL AND SCHEDULE CONTROLS SUPPORT RESOURCES SECURITY

QUALITY ASSURANCE

CONFIGURATION MANAGEMENT PLAN
DESIGN STANDARDS AND CONVENTIONS
COORDINATE SYSTEM DEFINITIONS
PROGRAMMING PRACTICES,
STANDARDS AND CONVENTIONS
TEST PROGRAM AND TEST DATA PLAN

STATINTL

PROJECT CONTROL DOCUMENTS (continued)

MANAGEMENT STATUS REPORTS

FINANCIAL DATA
CRITICAL PATH ANALYSES
TECHNICAL PROBLEMS
COMPUTER UTILIZATION

SUPPORT SYSTEMS

DOCUMENTATION TRAINING SECURITY ACTIVATION

STATINTL

THE DATA ITEM DESCRIPTION

TITLE, NUMBER, DATE, AND OFFICE OF PRIMARY RESPONSIBILITY
USE (PURPOSE WITHIN OR FOLLOWING THE CONTRACT)
INTERRELATIONSHIP (PRECEDENT OR DEPENDENT DOCUMENTS)
REFERENCES
PREPARATION INFORMATION

TABLE OF CONTENTS
APPLICABLE DOCUMENTS
BOILERPLATE
DETAILED CONTENT

NON-REPETITIVE REPETITIVE

FIGURES GLOSSARY INDEX APPENDICES

STATINTL

PROPOSAL EVALUATION

OBJECTIVES PROCESSES AND PROCEDURES

LEGAL FACTORS
MANAGEMENT FACTORS

CRITERIA

ELEMENTS SCORING

STATINTL

PROPOSAL EVALUATION OBJECTIVES

ELIMINATE UNRESPONSIVE OR INFEASIBLE APPROACHES

SOME BIDDERS DON'T KNOW THEY LACK NECESSARY BACKGROUND STATE OF THE ART IS NOT UNIFORMLY DISTRIBUTED

OBTAIN BEST VALUE FOR THE GOVERNMENT

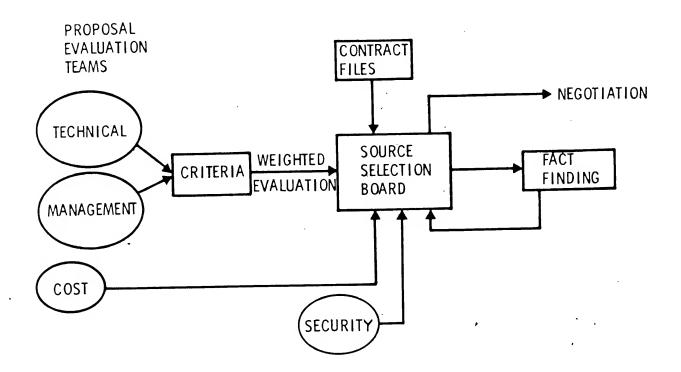
SHAVE UNNECESSARY FRILLS ASSURE EFFORT COMMENSURATE WITH APPROACH TRADE-OFF COST AND PERFORMANCE

ENFORCES OBJECTIVITY

MINIMIZE PERSONAL INFLUENCES
MAXIMIZE DEPENDENCY ON VERIFIABLE, RELEVANT,
AND BINDING INFORMATION

STATINTL

Proposal Evaluation Process



STATINTL

PROPOSAL EVALUATION PROCEDURES

ELIMINATING BIASES

ROTATING ORDER NORMALIZING SCORES LIMITING EARLY INTERACTIONS

KEEPING RECORDS

PARTICIPANTS
CRITERIA
WRITTEN CRITIQUES
DISQUALIFYING FACTORS
MINUTES OF DISCUSSIONS
VOTING

USE OF SPECIALISTS AND CONSULTANTS

PROBLEM PECULIAR PROPOSAL PECULIAR

STATINTL

TYPICAL DEVELOPMENT PROBLEMS

HARDWARE

ACCURACY, SPEED, SENSITIVITY
PACKAGING DENSITY
WEIGHT/VOLUME/POWER
RELIABILITY
PHYSICAL SURVIVABILITY
PRODUCTION QUALITY

SOFTWARE

COST & SCHEDULE ESTIMATION & CONTROL
IN-LINE DEPENDENCE ON OPERATING SYSTEM & COMPILER
HIDDEN ERRORS
DOCUMENTATION
MAINTENANCE COSTS
TRAINING REQUIREMENTS
REQUIREMENTS GROWTH
UNDERESTIMATED COMPUTE-POWER

STATINTL

TECHNICAL CRITERIA

REQUIREMENTS AUDIT

TRACEABILITY IMPLEMENTATION

FEASIBILITY

PRIOR APPLICATION
DETAILED SIZING AND TIMING STUDIES
ERROR ANALYSES
SENSITIVITY OR TRADE-OFF STUDIES

STATINTL

TECHNICAL CRITERIA

(continued)

COMPLETENESS

SOFTWARE .

DATA BASE ARCHITECTURE
MATHEMATICAL ALGORITHMS
HUMAN INTERFACES
CONTROL OPTIONS
OPERATING SYSTEM FEATURES
DEVELOPMENT TOOLS

HARDWARE

LOGIC
MOTION ANALYSIS
INTERFERENCE ANALYSIS
PRODUCABILITY
RELIABILITY
PACKAGING
AUTOMATIC TEST EQUIPMENT

OVERKILL

STATINTL

MANAGEMENT CRITERIA

PEOPLE AND ORGANIZATION

RELATIONSHIP TO PROPOSAL DEVELOPMENT TIME COMMITMENT AND CURRENT ASSIGNMENTS STAFFING RATE FEASIBILITY INDEPENDENT TEST AND INTEGRATION

SYSTEMS AND PRACTICES

EFFECTIVENESS TIMELINESS PROOF OF USE

STATINTL

MANAGEMENT CRITERIA

(continued)

EXPERIENCE

PRIOR SIMILAR JOBS LINKAGE TO INDIVIDUALS REFERENCES

SCHEDULE

INTERNAL MILESTONES
REVIEW CYCLES
CRITICAL PATH DEVELOPMENT
CREDIBILITY

STATINTL



BASIS

ENGINEERING ESTIMATES TOTAL SCOPE OF EFFORT REQUIRED LABOR MIX OVERHEAD ELEMENTS

DEFINITIONS

MAN-HOUR MONTH COMPUTER TIME

STATINTL



COST CRITERIA

(continued)

STANDARDS

JUDGING CREDIBILITY ESTABLISHING ALLOWABLES

GOVERNMENT RESOURCES

COMPUTER TIME MAN POWER TRAVEL BUDGETS

LIFECYCLE ESTIMATES

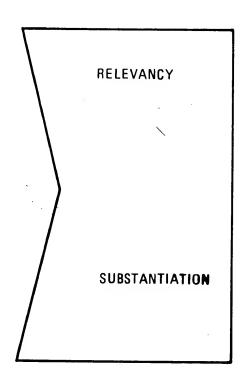
LIFE-SPAN ACTIVITIES DISCOUNT RATE

STATINTL



Proposal Evaluation Criteria

- TECHNICAL
 - REQUIREMENTS AUDIT
 - FEASIBILITY
 - COMPLETENESS
 - OVERKILL
- MANAGEMENT
 - PEOPLE AND ORGANIZATION
 - SYSTEMS AND PRACTICES
 - EXPERIENCE
 - SCHEDULE
- COSTS
 - BASIS
 - **DEFINITIONS**
 - STANDARDS
 - GOVERNMENT RESOURCES
 - LIFE CYCLE ESTIMATES



STATINTL



Separating Fact From Fiction

RELEVANCY

- DOES IT HELP MEET THIS SYSTEMS OBJECTIVES?
- DID IT INVOLVE THESE PEOPLE?
- HAS IT BEEN ASKED FOR?
- WAS THAT ENVIRONMENT (noise, data rate, schedule, cost)
 AS CONSTRAINING?

SUBSTANTIATION

- IS IT ASSERTED OR PROVEN?
- WHAT DATA HAS BEEN USED? WHAT IS ITS SOURCE?
 HOW WAS IT COLLECTED?
- WERE RECORDS KEPT, OR IS THIS A RECONSTRUCTION?
- WOULD A DIFFERENT GROUP OF PEOPLE OR SET OF DATA YIELD THE SAME RESULTS?

STATINTL

THE SURPRISE OF WINNING PROPOSAL TEAM TRANSITION INTERNAL PRIORITY.
CLEARANCES
PROJECT "REPUTATION"

STATINTL

ORGANIZING

CONFLICTING CONTRACTS
POWER STRUGGLES
DIFFERENCES IN APPROACH
PERSONAL STRENGTHS

STATINTL

INTERPRETATION OF REQUIREMENTS

LIMITED MISSION OR TECHNOLOGY EXPERIENCE
LIMITED PROJECT BACKGROUND
MISDIRECTED PRIOR EXPERIENCE
CONTRADICTORY OPERATIONAL INPUT
AMBIGUOUS SPECIFICATION

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STATINTL

LONG LEAD TIME PURCHASES

FAULTY PROJECT PLAN
LOW CORPORATE PRIORITY

INATTENTION

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STATINTL

AVOIDING TROUBLE

MEET ALL KEY STAFF
TEST CONTRACTOR'S INTERPRETATION OF RQMTS
CALIBRATE MORALE
RECHECK VALIDITY OF PROJECT PLAN
TEST IMPLEMENTATION OF PROJECT PLAN
KEEP A TOTAL PROJECT PERSPECTIVE
TRACK INITIAL STAFFING & ORGANIZATION
WALK AND TALK
MEET FREQUENTLY WITH PROJECT MANAGER

STATINTL

BE A CUSTOMER, NOT A GUEST

ESTABLISH A POSITION OF BEING IN CONTROL

INITIAL CONTACTS

RFP

BIDDERS CONFERENCE

FACT-FINDING

NEGOTIATIONS

USE FORMALITY TO MAINTAIN CONTROL

AGENDAS

MINUTES

ACTION ITEMS

CONFIGURATION CONTROL

USE INFORMALITY TO MAINTAIN RELATIONSHIPS

PEOPLE ARE YOUR MOST IMPORTANT RESOURCE

MANY REAL PROBLEMS REMAIN HIDDEN TO "THE SYSTEM"

YOU PLAY A KEY ROLE IN MOTIVATING CONTRACTOR EMPLOYEES

STATINTL

GOLDEN RULES OF ACQUISITION

BE SPECIFIC

BE CONSISTENT

BE SKEPTICAL

BE PERSISTENT

BE TIMELY

STATINTL

TECHNICAL PROGRESS ASSESSMENTS

STATUS MEETINGS
TECHNICAL INTERCHANGE MEETINGS
WORKING GROUPS
PROGRESS BRIEFINGS
SPECIAL AUDIT TEAMS
DESIGN REVIEWS

STATINTL

DESIGN REVIEWS IN DETAIL

OBJECTIVES
DOCUMENTATION
PROCESS
USEFUL PROCEDURES
REVIEW MANAGEMENT

STATINTL

DESIGN REVIEW OBJECTIVES

MEASURE PROGRESS

REFOCUS ATTENTION ON REQUIREMENTS,
INTERFACES & OPERATIONS

ASSURE COMPLIANCE
UNCOVER OVERSIGHTS
IDENTIFY COST-DRIVERS
ELIMINATE UNNECESSARY FRILLS
PROVIDE DEFINITIVE INTERMEDIATE MILESTONES
IMPROVES SCHEDULE ADHERENCE
PERMITS NOVEL INCENTIVE STRUCTURE
BASIS FOR CONFIGURATION CONTROL
STIMULATE CONTRACTOR INTERNAL COMMUNICATIONS
IMPROVED QUALITY
EARLY IDENTIFICATION OF PROBLEMS
CONTRIBUTE TO TRAINING

INTEGRATING CONTRACTOR
OPERATORS/USERS

STATINTL

REFERENCE DOCUMENTS

SYSTEM SPECIFICATION
DEVELOPMENT SPECIFICATIONS
PRODUCT SPECIFICATIONS
CRITICAL PARTS LIST
DATA DICTIONARY
HDW/SW LIMITATIONS AND CONSTRAINTS
INTERFACE CONTROL DOCUMENTS
TEST PLAN
TEST PROCEDURES
TEST REPORT
USERS MANUAL
PROGRAMMING MANUAL
MAINTENANCE MANUAL

STATINTL

CONSTRUCTIVE DOCUMENT REVIEWS

REQUIREMENTS SATISFACTION
COMPLETENESS
CONSISTENCY
ACCURACY/CORRECTNESS
KEEP EDITORIAL COMMENTS SEPARATE
SAY WHAT YOU WANT & WANT WHAT YOU SAY
AVOID PHILOSOPHIZING
SUGGEST CORRECTION IF KNOWN
AVOID SARCASM
REMEMBER YOUR OBJECTIVES
REQUIREMENTS
SCHEDULE
MONEY

STATINTL

USEFUL PROCEDURES

SYSTEM LEVEL REVIEWS

FORCES CONTRACTOR TO VIEW SYSTEM AS A WHOLE SAME PEOPLE/SAME ROOM/SAME TIME IMPROVES COMMUNICATION
RESOLVES UNCERTAIN RESPONSIBILITIES
COORDINATES RESPONSE TO CRITICAL PROBLEMS

REQUIREMENTS TRACES

DESIGN INTERFACES TEST PLAN

DATA OR SIGNAL TRACES

UNCOVERS INTERFACE PROBLEMS
PROMOTES UNDERSTANDING OF PROCESSES

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STATINTL



TEAM PREPARATION

SELECTION TRAINING WORK LOAD BALANCE

SETTING OBJECTIVES

REQUIREMENTS PRIORITIES KEY RISKS/ISSUES SELECTED THEMES

LOGISTICS

DOCUMENT DISTRIBUTION
COMMENT FORMS
COMMENT COLLECTION

STATINTL

REVIEW MANAGEMENT

(continued)

INTERNALLY COORDINATED RESPONSE

ELIMINATES REDUNDANCY AND NOISE FOCUSES ATTENTION ON CRITICAL ITEMS DISCUSSION UNFOLDS NEW ISSUES DOCUMENTS INPUTS

DOCUMENTED PROCEEDINGS

RECORDS RATIONALE
REDUCES MISUNDERSTANDINGS
PROMOTES FULLY DEFINED ACTION ITEMS
(who, what, when)
SIGNATURE ESTABLISHES CUSTOMER'S CONTROL

ACTION ITEM CLOSURE

FOLLOW-UP REVIEW ACCOUNTING

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STATINTL

ELEMENTS OF PROJECT CONTROL

DESCRIBE THE SYSTEM IN MEASURABLE TERMS

RACKS OF EQUIPMENT
CIRCUIT BOARDS
COMMERCIAL
CUSTOM
SOLDIER JOINTS

OPERATOR STATIONS
INPUT DEVICES
CONVENTIONAL
STATE OF THE ART
DISPLAY OPTIONS

SOFTWARE MODULES

NUMBER OF EQUATIONS OR ALGORITHMS

TEXT BOOK

NEW DERIVATIONS

LINES OF CODE

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STATINTL

ELEMENTS OF PROJECT CONTROL

IDENTIFY DISCRETE MILESTONES ASSOCIATED WITH THE DESIGN, DEVELOPMENT, PRODUCTION, TEST AND SUPPORT OF THE IDENTIFIED SYSTEM

PURPOSE DOCUMENTED
FUNCTIONS DESCRIBED
ARCHITECTURE APPROVED
DESIGN COMPLETED
FIRST TEST ATTEMPTED
TEST COMPLETED
INTEGRATION COMPLETED

PLAN, MEASURE AND CONTROL THE EFFICIENT APPLICATION OF RESOURCES (PEOPLE, MATERIAL, RESOURCES, TIME) TO THE ACHIEVEMENT OF MILESTONES

LEARNING/PREPARATION CREATING/USING VALIDATING/CORRECTING IDLE

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	y				
STATINTL					
	DESIGN CONCEPT REVIEW OBJECTIVES				
	IDENTIFY AND/OR IDENTIFY, NEGOTIA	NFIRM UNDERSTANDING OF REQUIREMENTS MODIFY HIGH COST OR HIGH RISK REQUIREMENTS ATE AND FREEZE EXTERNAL INTERFACES DATE CONTRACTOR'S DEVELOPMENT PLAN			

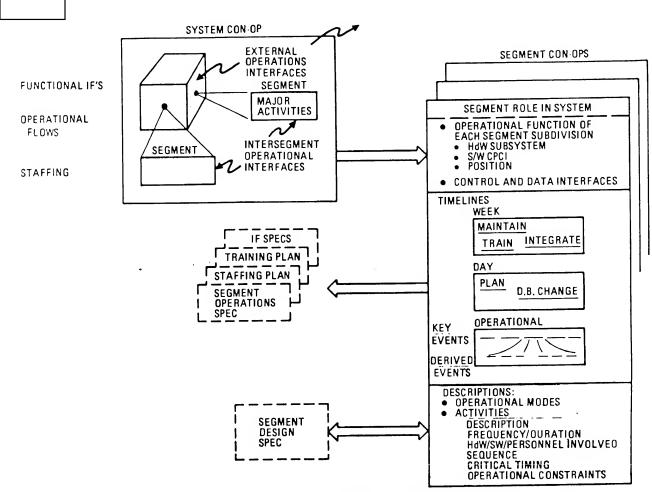
STATINTL

DCR AGENDA

OPERATIONS CONCEPT
REQUIREMENTS
TRADE STUDIES
DEVELOPMENT PLAN `
QUALITY ASSURANCE
CONFIGURATION CONTROL
REQUIREMENTS VERIFICATION
PRELIMINARY DEVELOPMENT SPECIFICATIONS

STATINTL

Concept of Usage



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STATINTL

HARDWARE REQUIREMENTS

GENERAL REQUIREMENTS

ENVIRONMENTAL COMPATIBILITY
RELIABILITY/MAINTAINABILITY/AVAILABILITY
OPERATIONAL SECURITY
FAULT DETECTION & ISOLATION
PRODUCIBILITY
LOGISTICS SUPPORT
TRANSPORTABILITY
DESIGN STANDARDS

STATINTL



ARCHITECTURE

FUNCTIONALITY
FAILURE MODES & EFFECTS
TESTABILITY

INTERFACES

FUNCTIONAL RELATIONSHIPS ELECTRICAL CONNECTIONS SIGNAL CODING MECHANICAL CONNECTIONS

STATINTL



FUNCTIONAL REQUIREMENTS

LOADS
SIGNALS
ACCURACY
TIMING
CONTROL

STATINTL

SOFTWARE REQUIREMENTS

GENERAL REQUIREMENTS

SECURITY/PRIVACY
ARCHIVING/RETRIEVAL
BACKUP/FALLBACK/RESTART
DESIGN STANDARDS

ARCHITECTURE

COMPUTER ENVIRONMENT SCHEDULE/CONTRACTOR OPERATIONAL ENVIRONMENT

STATINTL

SOFTWARE REQUIREMENTS (continued)

INTERFACES

DATA DESCRIPTION VOLUME MEDIA

FUNCTIONAL REQUIREMENTS

ACCURACY
THROUGHPUT
DETAILED TIMING
CONTROL

STATINTL

OPERATOR REQUIREMENTS

POSITION REQUIREMENTS

DESCRIPTION OF ROLE
TIMELINE
WORKLOAD ANALYSIS
SUPPORTING SUBSYSTEMS OR INFORMATION

TRANSACTION REQUIREMENTS

TASK DESCRIPTION
TIMELINESS REQUIRED
ACTIONS REQUIRED
ERROR EFFECTS, CONTROLS & RECOVERY
DECISION DATA AND BASIS

STATINTL

FACILITY REQUIREMENTS

REQUIREMENTS

POWER

COOLING

SPACE

STRUCTURAL

SERVICES

ACCESS

CONSTRAINTS

SECURITY ...

LOGISTICS

OPERATIONS

SAFETY

STATINTL

TRADE-OFF OPPORTUNITIES

TOTALLY DIFFERENT ALTERNATE APPROACHES

MODIFIED ALLOCATION OF REQUIREMENTS BETWEEN SUBSYSTEMS

VARYING LEVELS OF RELIABILITY, MEAN LIFETIME

VARYING LEVELS OF PRESUMED THREAT LEVELS

MANNED VS UNMANNED SYSTEMS

FACTORY VS FIELD CALIBRATION

USE OF DEMONSTRATION PROGRAM OR PROTOTYPE DEVELOPMENT

STATINTL

DEVELOPMENT PLAN

DEVELOPMENT TASK WBS

PLAN

SPECIFY

DESIGN

PRODUCE

VERIFY

DOCUMENT

TASK SCHEDULES AND DEPENDENCIES

MASTER TASK NETWORK

MAJOR MILESTONE

INTERNAL REVIEWS

INTERNAL AND EXTERNAL DEPENDENCIES

STATINTL

DEVELOPMENT PLAN (continued)

STAFFING AND ORGANIZATION

TASK RELATIONSHIP
MANAGEMENT AND SUPPORT
PROJECT/MATRIX ROLES
TRAINING

FACILITIES

DOCUMENT PRODUCTION
HARDWARE ASSEMBLY & TEST
SOFTWARE DEVELOPMENT
SECURE SPACE AND STORAGE
TEST DATA GENERATORS
ANALYSIS TOOLS

MANAGEMENT & TECHNICAL CONTROLS

COST REPORTING
CRITICAL PERFORMANCE
CONFIGURATION MANAGEMENT
SECURITY

STATINTL

QUALITY ASSURANCE

ESTABLISH DEVELOPMENT STANDARDS
MONITOR COMPLIANCE
PROVIDE VENDOR PARTS INSPECTION
AUDIT DELIVERED PRODUCTS

STATINTL

CONFIGURATION CONTROL

IMPLEMENT MANAGEMENT CONTROL OF PRIORITIES PREVENTS UNNECESSARY CHANGES ASSURES INTERFACE COORDINATION PROVIDES ORDERLY INTRODUCTION OF CHANGE

STATINTL

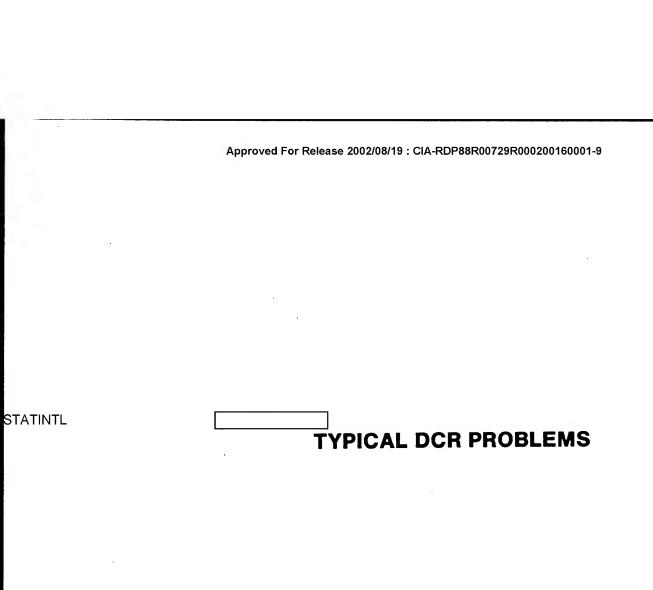
REQUIREMENTS VERIFICATION

REQUIREMENTS TRACEABILITY

VERIFICATION PLAN & MATRIX

INSPECTION
ANALYSIS
TEST/DEMONSTRATION

TEST PLANS AND PROCEDURES



STATINTL

INCOMPLETE REQUIREMENTS ALLOCATION

CAUSES

INEXPERIENCED CONTRACTOR
POOR ANALYSIS TOOLS
INADEQUATE SCHEDULE OR BUDGET

FAILURE TO CONSIDER DERIVED REQUIREMENTS

CONSEQUENCES

WASTED DESIGN EFFORTS

STATINTL

INCOMPLETE OPERATIONS CONCEPT

CAUSES

INSUFFICIENT USER CONTACT
INADEQUATE CONTRACTOR EXPERIENCE
INSUFFICIENT RESOURCES

CONSEQUENCES

ERRONEOUS INTERFACES
NON-TECHNICAL FACTORS IGNORED
IMPRACTICAL TIMELINES
UNREALISTIC TEST ENVIRONMENT

STATINTL

STAFFING DELAYS

CAUSES

CORPORATE PRIORITIES
UNREALISTIC PLANNING ASSUMPTIONS
CHANGING LABOR MARKET
CLEARANCES
PROJECT REPUTATION

CONSEQUENCES

IMPLEMENTATION DELAYS

MORE MATURE PRECEDENT PRODUCTS

STATINTL

NON-OPTIMUM LABOR MIX

CAUSES

INEFFECTIVE MATRIX MANAGEMENT DYNAMIC BUSINESS BASE

CONSEQUENCES

UNABLE TO WORK AROUND SCHEDULE CHANGES AMPLIFIED COST IMPACT

STATINTL



CAUSES

POLITICAL PRESSURE
REQUIREMENTS GROWTH
POOR INTERFACE DEFINITION
BUDGET REPROGRAMMING
COMPETING PROJECTS

CONSEQUENCES

POOR MORALE
CONSTANT REPLANNING
WASTED EFFORT
COST & SCHEDULE GROWTH

STATINTL

DOCUMENT PRODUCTION DELAYS

CAUSES

UNDERESTIMATED WORKLOAD
DELAYED INPUT
LOW PROJECT PRIORITY
INADEQUATE FACILITY

CONSEQUENCES

INADEQUATE REVIEWS
MISSED MILESTONES

STATINTL

REQUISITES FOR PROGRESS ASSESSMENT

A PLAN

TECHNICAL MANAGEMENT

INFORMATION

PROGRESS
RESOURCES
CONDITIONS

UNDERSTANDING OF INTERACTION

BUDGET VS PROGRESS BY ELEMENT CRITICAL PATH ITEMS PRECEDENCE RELATIONSHIPS

STATINTL

Quantified Measures

	REQ. ALLOC.	PRELIM. DESIGN & PROTOTYPE	CRITICAL DESIGN & DEVELOPMENT	PRODUCTION & TEST	INTEGRATION
HARDWARE	NO. OF CRITICAL REQUIREMENTS NO. OF FUNCTIONS NO. OF SUBSYSTEMS NO. OF OPERATING MODES NO. OF TBO's/TBR's PAGES OF DOCUMENTATION	RACKS OF EQUIPMENT NO. OF STRUCTURES NO. OF OISPLAYS NO. OF CABLES NO. OF ASSEMBLY POSITIONS NO. OF ORAWINGS NO. OF RISK ITEMS	NO. OF CIRCUITS NO. OF INTERFACES NO. OF INTERFACES HOURS OF BURN-IN NO. OF ENCLOSURES NO. OF MECHANISMS	UNITS COMPLETED TESTS COMPLETED UNITS ACCEPTED HOURS OF REASSEMBLY	NO. OF TESTS TESTS EXECUTEO TEST PASSE O TESTS IN ANALYSIS
SOFTWARE	NO. OF CRITICAL REQ. NO. OF FUNCTIONS NO. OF CPCI'S NO. OF OPERATING MODES NO. OF TBO's/TBR'S PAGES OF OOCUMENTATION	NO. OF MENU'S OATA BASE SIZE NO. OF MODULES NO. OF CRITICAL ALGORITHMS NO. OF SPEC. COMMENTS NO. OF INTERACTIONS NO. OF OERIVED REQUIREMENTS	LINES OF CODE NO. OF OATA ITEMS SPEED OF EXECUTION WORDS OF MEMORY USEO ; NO. OF CHANGES	PATHS EXECUTED MODULES COMPLETED LINES OF CODE PRODUCEO TEST DATA DEVELOPED TESTS EXECUTED TESTS EXECUTED TESTS PASSED TESTS IN ANALYSIS	NO. PEOPLE TRAINEO
OPERATIONS	NO. OF CRITICAL REQ. NO. OF POSITIONS NO. OF OPS. SCENARIOS NO. OF FUNCTIONS PAGES OF OCCUMENTATION	NO. OF CRITICAL TASKS NO. OF SLACK HOURS NO. OF ACTIONS HOURS OF TRAINING ITEMS TO BE MAINTAINEO	NO. OF MANUALS NO. OF CHAPTERS NO. OF PAGES NO. OF PEOPLE TO BE TRAINED	NO. TRAINING SESSIONS DESIGNED NO. OF COPIES PRODUCEO NO. OF PROCEOURES DEVELOPED	NO. PEOPLE TRAINEO
SEGMENT	NO. OF INTERFACES	NO. OF TEST DRIVERS NO. OF TEST SCENARIOS	NO. OF ITERATIONS ON PLANS NO. OF WALLS CONSTRUCTEO	HOURS OF TEST OUTLETS INSTALLED	NO. OF OEMONSTRATION NO. OF REQUIREMENTS SATISFIED

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Milestones

ANALYSIS	DOCUMENT (SPECS)	PRODUCT	ACTIVITY (TESTS)
SUBJECTS IDENTIFIED •	PURPOSE DEFINED	REQUIREMENTS DEFINED	PURPOSE DEFINED
OBJECTIVES STATED	AUDIENCE DESCRIBED	REQUIREMENTS APPROVED	PARTICIPANTS IDENTIFIED
APPROACH DEFINED .	OUTLINE COMPLETED	ARCHITECTURE DEFINED DEVELOPMENT APPROACHS	DBJECTIVES DEVELOPEO
DATA IOENTIFIED	OUTLINE APPROVED	PROPOSED DEVELOPMENT APPROACH	ENVIRONMENT DEFINED
DATA OBTAINED	151 ORAFT COMPLETED	SELECTED AFFROACH	SEQUENCE DEVELOPED
TOOLS IDENTIFIED	2nd DRAFT COMPLETED	PRODUCTION TOOLS OFFINED FACILITY REQUIREMENTS	RESDURCES IDENTIFIED
TOOLS DEVELOPED	DRAFT DISTRIBUTED	DEFINED	PARTICIPANTS NOTIFIED
OUTPUT RESULTS DEFINITIZED	ORAFT COMMENTS RETURNED	TEST REQUIREMENTS DEFINED	INSTRUCTIONS DEVELOPED
INTERMEDIATE STAGES DEFINED	COMMENTS INCORPORATED	OATA BASE DESIGNED CONTROL LOGIC COMPLETED	RESOURCES PROVIDED
STAGES ACCOMPLISHED	FINAL ORAFT COMPLETED	DESIGN COMPLETED	ACTIVITY CONDUCTED
RESULTS OBTAINEO	FINAL DRAFT APPROVED	PRODUCTION TOOLS AVAILABLE	ASSESSMENT COMPLETED
ANALYSIS CONCLUDED	PRODUCTION COMPLETED	INPUT/OUTPUT CODED PROTOTYPE COMPLETED	LOGISTICS CONCLUDED
	DISTRIBUTION COMPLETED	PRODUCTION INITIATEO	
•		PRODUCTION COMPLETED	
		TEST INITIATED	
		TEST COMPLETED	
		PRODUCT SHIPPED	

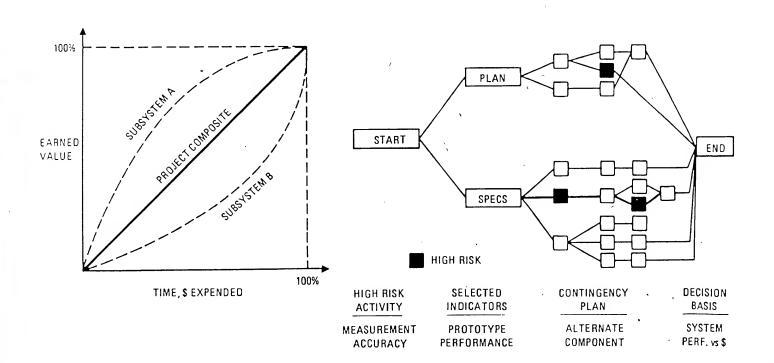
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STATINTL **Earned Value Process (Cumulative)** System DCR 10C **PDR** CDR Assembly **Production** Test System Engineering Hardware Development Software Development System Test **Production Operations Support** Planned Actual Deviation Cause Element Value Cost Value Cost Value 320K 240K | 250K -80K +10K Staffing/Salaries 160K 80K 160K -80K +80K **Clock Stability**

STATINTL



Balancing Progress



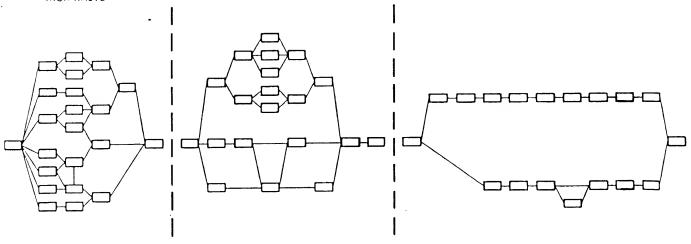
STATINTL



Schedule Effects

- ◆ LARGE TEAM
- MANY INTERFACES/ INTERACTIONS
- FREQUENT SLACK = HIGH WASTE
- INDEPENDENT FUNCTIONS
- OPTIMUM SKILL MIX

- HIGH PROBABILITY OF EXTERNAL CHANGES
- PERSONNEL TURNOVER
- SKILLS COMPROMISED



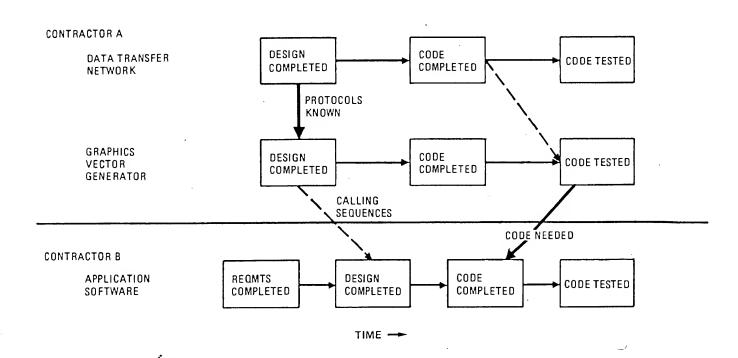
COMPRESSED

BASELINE

STRETCHED

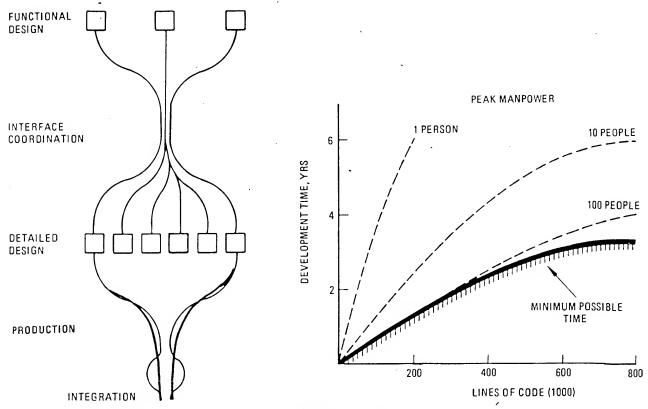
STATINTL

Development Interdependencies



STATINTL

Bottlenecks & Interfaces Limit Schedules



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STATINTL

PROGRESS REPORTS

WORK REMAINING

SUMMARY OF PLAN
DETAILS OF DIVERGENCE

RESOURCES AVAILABLE

MONEY
PEOPLE
COMPUTER TIME
HARDWARE AND FACILITIES
TIME

CORRECTIVE ACTIONS PROPOSED OR TAKEN

MANAGEMENT TECHNICAL

STATINTL

How to Make Your Project Proceed Exactly According to Plan



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STATINTL

PDR OBJECTIVES

STABILIZE THE DESIGN ARCHITECTURE
DESCRIBE TRADEOFFS AND SELECTION RATIONALE
IDENTIFY KEY RISKS AND LONG-LEAD ITEMS
ESTABLISH TOTAL PROJECT STATUS
REFINE COST & SCHEDULE ESTIMATES
CONFIRM OR REVISE DEVELOPMENT PLAN

STATINTL

PRELIMINARY DESIGN REVIEW AGENDA

DCR PROBLEMS

FUNCTIONAL FLOW

ELECTRICAL SUBSYSTEMS

CIRCUITS
COMMUNICATIONS ENCODING
POWER

MECHANICAL SUBSYSTEMS

MECHANISMS STRUCTURES EXPLOSIVE DEVICES

DATA SUBSYSTEMS

GENERAL
COMPUTERS
PERIPHERALS
COMMUNICATIONS/DATA HANDLING EQUIPMENT

OPERATOR STATIONS
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STATINTL

PRELIMINARY DESIGN REVIEW AGENDA (co

(continued)

SOFTWARE SUBSYSTEMS

INPUT & OUTPUT
CONTROL
PROCESSING & KEY ALGORITHMS
DATA BASE ARCHITECTURE
TIMING AND STORAGE

AVAILABILITY/RELIABILITY/MAINTAINABILITY

INTERFACE REQUIREMENTS

DEVELOPMENT PLAN REVISIONS

MANUFACTURING

PRELIMINARY TEST PLANS

SUPPORT TOOLS

SYSTEM TRANSITION AND INTEGRATION PLAN

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STATINTL

OPERATIONAL REQUIREMENTS

OPERATOR REQUIREMENTS

FUNCTIONS
RESPONSE TIME
SKILL
ERROR CONDITIONS

OPERATIONAL CONSTRAINTS

MUTUALLY EXCLUSIVE EVENTS

MUTUALLY EXCLUSIVE OPERATIONAL REQUIREMENTS

EXTERNAL INTERFACE DYNAMICS

STATINTL

ELECTRICAL SUBSYSTEMS DESIGN (continued)

GENERAL

SAFETY
SECURITY
CALIBRATION
BUILT-IN-TEST

POWER

PRIMARY SOURCE
STORAGE DECAY CHARACTERISTICS
LOADING ANALYSIS

CONTROLS

RESPONSE CHARACTERISTICS STABILITY ACCURACY

FAILURE ANALYSIS
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STATINTL

ELECTRICAL SUBSYSTEMS DESIGN (continued)

COMMUNICATIONS

ERROR-DETECTION & CORRECTION TECHNIQUES AVERAGE & PEAK LOADING BUFFER REQUIREMENTS LINK MARGINS

SPECIAL CIRCUITS

SYSTEM RESPONSE PROPERTIES **RELIABILITY ANALYSIS** FAILURE MODES & EFFECTS

STATINTL

ELECTRICAL SUBSYSTEMS DESIGN (continued)

SOLID STATE DEVICES

SENSITIVITY
DYNAMIC RANGE
SATURATION CHARACTERISTICS

TRADE-OFF STUDIES

WEIGHT vs LINK MARGIN SENSITIVITY vs SPATIAL COVERAGE POWER SHELF LIFE vs WEIGHT

STATINTL

MECHANICAL SUBSYSTEMS DESIGN

GENERAL

SAFETY MARGINS
ENVIRONMENTAL PROTECTION
OPERATING LIFE (CYCLES)

STRUCTURES

MATERIALS
OADS ANALYSIS
FAILURE ANALYSIS
THERMAL DISTORTION

STATINTL

MECHANICAL SUBSYSTEMS DESIGN

(continued)

MECHANISMS

DESIGN APPROACHES
CLEARANCES
DYNAMIC ANALYSIS
POWER REQUIREMENTS

HYDRAULIC

PRESSURE VESSEL DESIGN
SEALS
VALVES
RELIABILITY

STATINTL

MECHANICAL SUBSYSTEMS DESIGN

THERMAL

ENVIRONMENTAL ANALYSIS CONTROLS

PYROTECHNIC . -

SAFETY STABILITY RELIABILITY

STATINTL

DATA SUBSYSTEMS DESIGN

GENERAL

MTBF/MTTR
NOISE/HEAT/AIR VELOCITY
EMI
FAULT DETECTION
BUILT-IN-TEST

COMPUTERS

INSTRUCTION SET EXECUTION RATE I/O CHANNELS WORD LENGTH

STATINTL

DATA SUBSYSTEMS DESIGN

(continued)

PERIPHERALS

I/O RATE
VOLUME
SEEK TIME
PRINT RATE

STATINTL

DATA SUBSYSTEMS DESIGN

(continued)

.COMMUNICATIONS/DATA HANDLING EQUIPMENT

BANDWIDTH/DATA RATE
WORD LENGTH
ENCODING METHOD
NUMBER OF CHANNELS
STATUS MONITORING
ERROR DETECTION AND CORRECTION
BIT ERROR RATE
FAILURE RECOVERY MODES

STATINTL

DATA SUBSYSTEMS DESIGN

(continued)

OPERATOR STATIONS

FUNCTIONS
INPUT DEVICES
DISPLAY CHARACTERISTICS
RESPONSIVENESS

TRADE-OFF STUDIES

BUILT-IN-TEST vs DEPOT MAINTENANCE
NET ERROR RATE vs NET DATA RATE
TRAINING TIME vs WORK LEVEL THROUGHPUT

STATINTL

SOFTWARE SUBSYSTEMS DESIGN

GENERAL

LANGUAGE
PROGRAMMING STANDARDS
COMMERCIAL HARDWARE
COMMERCIAL SOFTWARE
CONCURRENT REQUIREMENTS
SECURITY/PRIVACY

INPUT

DESCRIPTION
UNITS
SOURCE
RANGES/LIMITS
ACCURACY/PRECISION
FREQUENCY/VOLUME
MESSAGE FORMATS

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STATINTL

SOFTWARE SUBSYSTEMS DESIGN

(continued)

PROCESSING

FUNCTIONAL DESCRIPTION
CONTROL OPTIONS
COORDINATE SYSTEMS
ACCURACY
SEQUENCE OR TIMING
KEY ALGORITHMS
DATA BASE DESIGN STRUCTURE
STIMULI AND RESPONSE
THROUGHPUT
RESPONSE TIME

OUTPUT

DESCRIPTION
DESTINATION
UNITS
ACCURACY/PRECISION
FREQUENCY/VOLUME

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STATINTL

SOFTWARE SUBSYSTEMS DESIGN

(continued)

CONTINGENCY RESPONSES

ERROR DETECTION/CORRECTION
BACKUP
FALLBACK
RESTART

MAN/MACHINE INTERFACE

CAPABILITY
RESPONSE TIME
DISPLAY DENSITIES/COLORS

TRADE-OFF STUDIES

RE-COMPUTATION TIME vs STORAGE ACCURACY vs TIMING MENU DRIVEN vs COMMAND DRIVEN ON-LINE vs OFF-LINE ARCHIVING

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STATINTL

DESIGN METHOD DIFFERENCES

HARDWARE

PIECE PARTS AS BUILDING BLOCKS STANDARD PARTS AVAILABLE

> COMPONENTS CONNECTORS

TECHNOLOGY DIFFERENCES WELL QUANTIFIED

MOS/BIPOLAR/CCD HONEYCOMB/COMPOSITES PCM/FDM/AM

NEW PARTS ARE DESIGNED WITH MULTIPLE APPLICATIONS IN MIND FEW DECISIONS MADE "ON THE ASSEMBLY LINE" CAN EFFECT PERFORMANCE

STATINTL

DESIGN METHOD DIFFERENCES (continued)

SOFTWARE

ROUTINE IS THE BUILDING BLOCK ONLY BASIC MATH BUILDING BLOCKS

TRIG FUNCTIONS
SOME STATISTICAL AND SIGNAL ANALYSIS PACKAGES
LIMITED DATA BASE OPTIONS
AVAILABILITY VARIES WITH HOST MACHINE MARKET SIZE

TECHNOLOGY DIFFERENCES HOTLY DEBATED

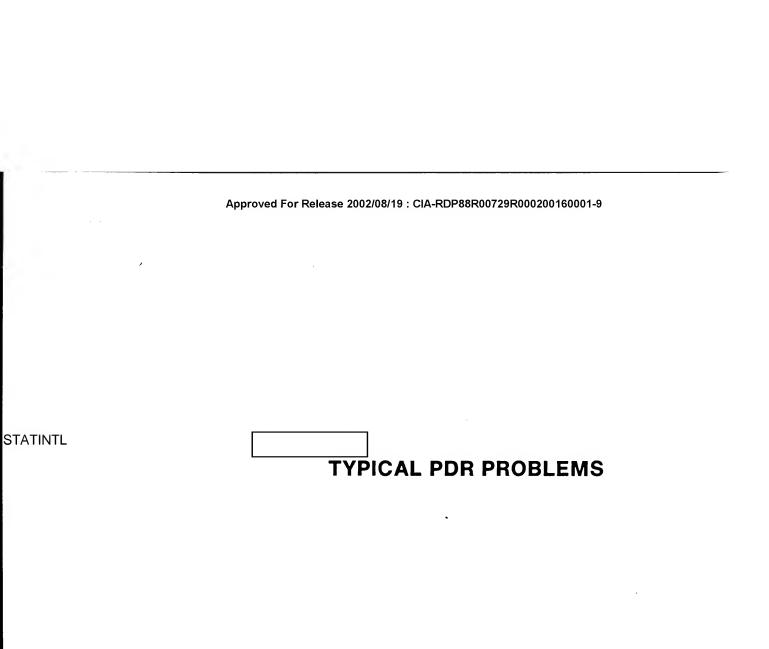
ADA vs JOVIAL vs FORTRAN
RELATIONAL vs HIERARCHICAL DATA STRUCTURES

NEW ROUTINE ARE DESIGNED ONLY FOR THIS APPLICATION
MANY DECISIONS MADE "ON THE ASSEMBLE LINE" EFFECT
PERFORMANCE

STATINTL

PRELIMINARY TEST PLANS

TEST PROGRAM PHILOSOPHY & STRUCTURE
TEST DESCRIPTIONS
SUCCESS CRITERIA
TEST SEQUENCE
INPUT AND ANALYSIS PREPARATION
RESOURCES
CONTROLS AND REPORTING



STATINTL

POOR INTERFACE DEFINITION

CAUSES

WEAK INTEGRATOR
ASYNCHRONOUS SCHEDULES
PROFIT MOTIVE

CONSEQUENCES

DESIGN GAPS SCHEDULE SLIP

STATINTL

INCOMPLETE SYSTEMS ENGINEERING

CAUSES

BUDGET SQUEEZE
INADEQUATE SOW
UNAGGRESSIVE LEADERSHIP
CONTRACTOR INEXPERIENCE
ERROR SOURCES NOT RECOGNIZED

CONSEQUENCES

UNATTAINABLE ACCURACY SPECIFICATIONS
DEGRADED AVAILABILITY
INCREASED FAILURE IMPACT
MISSED TIMELINES
DIMINISHED SENSITIVITY
LOST DATA
INVALID ARCHITECTURE
LATE REQUIREMENTS ADDED
COST AND SCHEDULE GROWTH

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STATINTL/

INCOMPLETE OPERATOR POSITION DEFINITION

CAUSES

INSUFFICIENT USER CONTACT UNSKILLED CONTRACTOR

CONSEQUENCES

REDUCED SYSTEM THROUGHPUT
LATE DEFINITION OF OUTPUT REQUIREMENTS

STATINTL

UNIDENTIFIED LONG-LEAD ITEMS

CAUSES

INCOMPLETE TEST PLANNING INCOMPLETE PRODUCTION PLANNING GOVERNMENT FURNISHED DATA

CONSEQUENCES

COST & SCHEDULE GROWTH

STATINTL

POOR QUALITY DOCUMENTATION

CAUSES

LACK OF EXPLICIT GUIDANCE UNREALISTIC SCHEDULE INEFFECTIVE INTERNAL REVIEWS BAD WRITERS

CONSEQUENCES

DIFFICULT TRANSITION BETWEEN PHASES COST & SCHEDULE GROWTH

STATINTL

INADEQUATE SUBCONTRACT VISIBILITY

CAUSES

CONTRACT FLAWS
PASSIVE GOVERNMENT PROGRAM OFFICE
CONTRACTOR STRATEGY

CONSEQUENCES

MISSED OPPORTUNITIES
REACTIVE GOVERNMENT ROLE

STATINTL

UNINFORMATIVE PROGRESS REPORTS

CAUSES

QUALITATIVE REPORTING
NO COMPARISON TO A PLAN
TOO HIGH A LEVEL OF SUMMARY
TOO MUCH DETAIL
OUTDATED INFORMATION

CONSEQUENCES

HIDDEN PROBLEMS
COST AND SCHEDULE GROWTH
COUNTERPRODUCTIVE ACTIONS

STATINTL

REQUIREMENTS RISK

SOURCES

ILL-DEFINED MISSION
LACK OF USER CONSENSUS
POORLY UNDERSTOOD ENVIRONMENT

CLUES

CONFLICTING SUB-MISSION PRIORITIES
DIVERSE OPINIONS REGARDING SOLUTION CHARACTERISTICS
LACK OF DEFINITION

REDUCTION

USER COORDINATION ENVIRONMENTAL SAMPLING CONCEPT DEFINITION PHASE

STATINTL



SOURCES

PHYSICAL PROPERTIES
DESIGN INSTABILITY
UNREALISTIC PERFORMANCE
UNPROVEN LONG TERM EFFECTS
SHORTSIGHTEDNESS

CLUES

LAGGING DEFINITION OF PROJECT ELEMENTS UNCALIBRATED ASSUMPTIONS CONTRARY OPINIONS

REDUCTION

DESIGN REVIEWS
PROTOTYPES
MULTIPLE PROCUREMENTS

STATINTL

MECHANICAL SYSTEMS

SOURCES

MATERIAL PROPERTIES
ENVIRONMENTAL RESPONSE
SAFETY MARGIN
DYNAMIC DISTORTION

ESTABLISHING EXTENT

LABORATORY TESTS
ENVIRONMENTAL SAMPLING
ENGINEERING ANALYSIS

STATINTL

ELECTRONIC SYSTEMS

SOURCES

COMPONENT STABILITY
PACKAGING DENSITY
PRODUCTION YIELDS
ENVIRONMENTAL AGING

ESTABLISHING EXTENT

LABORATORY TESTS
PROTÓTYPE DEVELOPMENT
ENVIRONMENTAL TESTS
QUALITY CONTROL SYSTEMS
COMPUTER AUTOMATED DESIGN

STATINTL



SOURCES

RESOURCE CONTENTION RESPONSE UNDER LOAD SOFTWARE RESOURCE DEMANDS

ESTABLISHING EXTENT

BENCHMARK TESTING DETAILED SIMULATION USER SURVEYS

STATINTL

SOFTWARE

SOURCES

COMPILER/OPERATING SYSTEM MATURITY COMPUTER ARCHITECTURE COMPATIBILITY PROBLEM DOMAIN KNOWLEDGE UNREALISTIC PERFORMANCE LEVELS

ESTABLISHING EXTENT

SOFTWARE USER SURVEYS
CONTRACTOR SITE OBSERVATIONS
DETAILED SIMULATION

STATINTL

SOFTWARE vs HARDWARE

CATCH-ALL FOR PROBLEMS

CANNOT BE SOLVED IN HARDWARE
DON'T KNOW HOW TO IMPLEMENT IN HARDWARE
TOO ILL-DEFINED FOR HARDWARE
CATCH-UP FOR EARLY DESIGN OVERSIGHTS

REQUIRE KNOWLEDGE OF OTHER "DESIGNS"

DATA COLLECTOR OPERATIONAL PARAMETERS
REAL-TIME DATA CORRUPTION
OPERATOR "PREFERENCES"
EXISTING ACCOUNTING PROCEDURES

STATINTL

SOFTWARE vs HARDWARE

(continued)

MORE INTERFACES PER MODULE

HARDWARE

CONNECTORS

SWITCHES

(USUALLY) WELL DEFINED INPUT/OUTPUT

SOFTWARE

OPERATOR CONTROLS

OPERATING MODES

DISPLAY OPTIONS

MYRIAD OF DATÁ INTERFACES

EMBEDDED INTERFACES (DATA-DRIVEN BRANCHES)

STATINTL

SOFTWARE vs HARDWARE

(continued)

INTANGIBLE DESIGN

CANNOT BE TOUCHED OR SEEN CONCEPTUAL IN NATURE "EASY TO CHANGE"

YOUNGER TECHNOLOGY

CHANGING STANDARDS & CONVENTIONS CHANGING DESIGN METHODS

STATINTL

COST & SCHEDULE RISK

SOURCES

REQUIREMENTS & TECHNICAL
CONTRACT TERMS
CONTRACT DELAYS
MANAGEMENT
UNCONTROLLABLE

CLUES

FREQUENT CHANGES TO PLANS NO CHANGES TO PLANS UNDER OR OVER STAFFING MISSED MILESTONES

REDUCTION

SPECIAL AUDITS
SUBCONTRACTS

PHASED DELIVERIES
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CDR OBJECTIVES

VALIDATE DESIGN APPROACH AND STANDARDS
AFFIRM TEST, INTEGRATION AND TRANSITION RESOURCES
ASSURE ADEQUATE TEST PROGRAM
CALIBRATE DEVELOPMENT PROGRESS

STATINTL

CRITICAL DESIGN REVIEW AGENDA

PDR PROBLEMS
PRODUCT SPECIFICATIONS

DETAILED FLOW DEFINITION PROCESS DESCRIPTIONS SCHEMATIC DIAGRAMS PROTOTYPE RESULTS

DATA BASE SPECIFICATION

FILE STRUCTURE
ITEM DESCRIPTIONS
INDEXING/LINKAGE

INTERFACE SPECIFICATIONS

ENCODING
PROTOCOLS
CONNECTOR DESIGNS

STATINTL

ASSEMBLY TOOLING PARTS INSPECTION RESULTS TEST PLANS

TEST RELATIONSHIPS
DATA SOURCES
TEST EQUIPMENT
PRELIMINARY PROCEDURES
ACCEPTANCE CRITERIA

INSTALLATION DRAWINGS
RELIABILITY
SAFETY
SUPPORT DOCUMENTATION

EQUIPMENT OPERATION MANUALS LOGISTIC SUPPORT PLANS

STATINTL

HARDWARE SPECIFICATIONS

ELECTRICAL

CIRCUIT LAYOUTS
POWER BUSSES & GROUNDING
SHIELDING DESIGN

MECHANICAL

FINAL DRAWINGS
FINAL PACKAGING
FINISH INSTRUCTIONS

THERMAL CONTROL

COATING SPECIFICATIONS

ELECTRO-MECHANICAL INTERFACES

CONNECTORS LINKAGES

STATINTL

HARDWARE SPECIFICATIONS (continued)

MASS PROPERTIES

SIZE WEIGHT INERTIAL PROPERTIES

PACKAGING & TRANSPORTATION

SHOCK & VIBRATION MOUNTINGS THERMAL WRAPS STATIC DISCHARGE WRAPS

RELIABILITY/MAINTAINABILITY/AVAILABILITY

PARTS INSPECTION PROGRAM ENVIRONMENTAL TESTING

SAFETY/SECURITY

SWITCH COVERS
DESTRUCTIVE DEVICES
SHIELDING

STATINTL

DESIGN ANALYSIS & TEST DATA

DETAILED LOGIC DIAGRAMS
CIRCUIT DIAGRAMS
PROCESSING ALGORITHMS
TIMING ANALYSIS
INPUT/OUTPUT DATA LINES

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STATINTL

DESIGN RELIABILITY

LOADS ANALYSIS
FAILURE MODES & EFFECTS ANALYSIS
THERMAL ANALYSIS

STATINTL

PRODUCIBILITY

MANUFACTURING TECHNOLOGY ASSEMBLY TOOLING ASSEMBLY PLAN PARTS AVAILABILITY QUALITY CONTROL

STATINTL

SOFTWARE SPECIFICATIONS

INPUT

NAME

FORMAT

DEVICE

PRIORITY

STATIC DATA

NAME

DEVICE

NUMBER OF RECORDS OR ENTRIES

DEFINITIONS

STATINTL

SOFTWARE SPECIFICATIONS (continued)

CPC DESIGN

LOGIC

DATA FLOW

ERROR CHECKS

ERROR MESSAGES/RESPONSES

EQUATIONS

ALGORITHMS

INTERNAL VARIABLES

CALLING RELATIONSHIPS

BUFFERS/TEMPORARY STORAGE

INTERRUPTS

STATINTL

SOFTWARE SPECIFICATIONS (continued)

GRAPHIC REPRESENTATION

SEQUENCE ITERATION BRANCHES

OUTPUT

DISPLAY FORMATS/MEANS RECIPIENTS/NOTIFICATION FILE FORMAT STORAGE DEVICE

LIMITATIONS OR CONSTRAINTS
MEMORY AND STORAGE ALLOCATIONS
CRITICAL TIMING

STATINTL

DATA BASE SPECIFICATION

LOGICAL DESCRIPTION

FILE-RECORD-FIELD DESCRIPTIONS
USE
FORMAT DEFINITIONS
POINTERS AND CHAINS
MARKERS

FUNCTIONAL DESCRIPTION

SET/USE ARCHIVING PURGING

PHYSICAL DESCRIPTION

FILE SIZE
DEVICE ALLOCATIONS
RECORDING FORMATS, DENSITY, PARITY

PASSWORD ACCESS

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STATINTL

SEGMENT DESIGN INTERFACES

SOFTWARE/DATA BASE

DATA TRANSFERS
REDUNDANCY/ARCHIVING
PRIVACY

SOFTWARE/HARDWARE

CONTROL
COMPUTATIONAL RESOURCES

OPERATIONS/SOFTWARE

DATA ENTRY AND RETRIEVAL SYSTEM OPERATIONS CONTROL SOFTWARE EXECUTION LEVELS

OPERATIONS/HARDWARE

DISPLAY AND CONTROL DEVICES CHARACTERISTICS MESSAGE AND ALARM CHARACTERISTICS

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REQUIREMENTS VERIFICATION

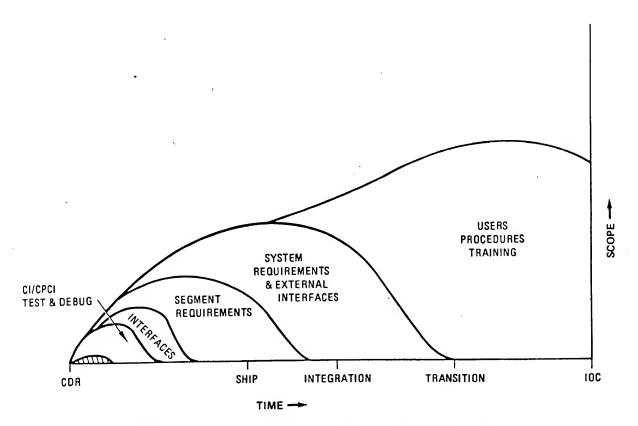
SPECTRUM OF METHODS AND ACTIVITIES

TESTING

PITFALLS

STATINTL





STATINTL

REQUIREMENTS VERIFICATION METHODS

INSPECTION

TRAINING PROGRAM
EQUIPMENT SURFACE FINISH
MODULARITY

ANALYSIS

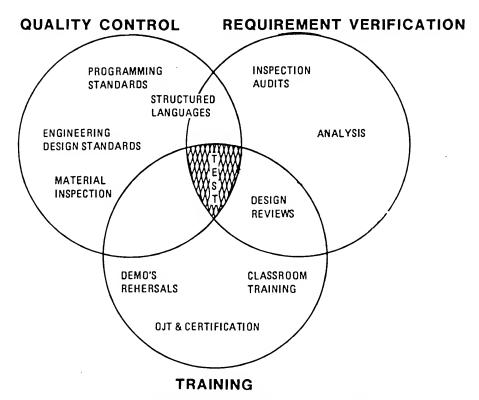
AVAILABILITY ACCURACY

TEST

RESPONSE TIME UNDER LOAD OPERATING MODES

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The Three Faces of Testing



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EVOLVING TEST ACTIVITIES

CODE AND DOCUMENTATION REVIEW

BENCH TEST RESULTS

ANALYSIS RESULTS

CONTROLLED TESTS

KNOWN INPUT

SIGNAL PROFILE TORQUE CHECK NUMBER

DETERMINISTIC OUTPUT

ENERGY MEASURE YIELD STRAIN AMOUNT PAYABLE

STATINTL

EVOLVING TEST ACTIVITIES

(Continued)

DEMONSTRATION TESTS

CALIBRATED INPUT

DYNAMIC LOADS PROFILE SIGNAL ENVIRONMENT TAPE DAILY ACCOUNT ACTIVITY

BOUNDED RESULTS

DEFLECTION HISTORY REPORTS TIMELINE SYSTEM RESPONSE TIME

STATINTL

TEST ACTIVITIES AND PROCEDURES

REQUIREMENTS SATISFACTION

DATA BASE ADEQUACY
PRIOR CALCULATIONS AND BASELINES
PARTIAL SATISFACTION

TEST PROGRAM MANAGEMENT

TEST TEAM STAFFING
SCHEDULING FIXED RESOURCES
TEST SEQUENCE PRECEDENCE RELATIONSHIPS
TEST REQUIREMENTS SATISFACTION MATRIX

FINAL AUDITS

PRIORITIZE PRODUCTS
PROPORTIONAL TO TEST INDUCED CHANGES

LIENS AND WAIVERS

STATINTL

TEST SCHEDULING PITFALLS

OPTIMISM

FAILURE RATE
PROBLEM ISOLATION
TIME TO REPAIR
ANALYSIS TIME

OVERSIGHTS

RECONFIGURATION TIME
COMPUTER AVAILABILITY
FACILITY OPERATIONAL REQUIREMENTS

EFFICIENCY

RESCHEDULING RESPONSE TIME PERSONNEL AVAILABILITY RECOMPILE/RECONNECT TIME

STATINTL

SEGMENT TEST PLAN

TEST PROGRAM PHILOSOPHY AND STRUCTURE

FUNCTIONAL/INTERFACES
RE-TESTING
DRIVERS/STUBS
ON-SITE TESTING
BUILD SEQUENCE

TEST DESCRIPTIONS

RANGE OF CONDITIONS
TEST DATA OR ENVIRONMENT
ACCEPTANCE CRITERIA

STATINTL

SEGMENT TEST PLAN (continued)

TEST FLOW

INTERRELATIONSHIPS DEPENDENCIES

IMPLEMENTATION PLAN

EXTERNAL DATA & CONTINGENCY PLANS
SCHEDULE
EQUIPMENT/SOFTWARE/PERSONNEL NEEDED

MANAGEMENT CONTROLS

STATINTL

SEGMENT TEST PROCEDURE

TEST OBJECTIVES

GENERAL MEASURABLE

OPERATING PROCEDURES

SWITCH SETTINGS

TAPE MOUNTING

POSITION MANNING AND FUNCTION

OPERATING SEQUENCE

OPERATOR INTERVENTION INSTRUCTIONS

STATINTL

SEGMENT TEST PROCEDURE

DETAILED DESCRIPTION

INTERFACE REQUIREMENTS
TEST SCENARIO
OPERATOR DATA REQUIREMENTS
TEST DATA BASE DEFINITION
SIMULATED INPUT DATA
OPERATING MODE DEFINITION
OBSERVABLE EVENTS - SEQUENCE AND DEPENDENCY
INSTRUMENTATION OR RECORDING REQUIREMENTS

ANALYSIS PROCEDURES

DATA REDUCTION OR SUMMARY FORMATS
STATISTICAL METHODS AND EQUATIONS
REQUIRED DATA CONVERSIONS OR HAND CALCULATIONS

ACCEPTANCE CRITERIA

STATINTL

ACCEPTANCE CRITERIA

WHAT SPECIFIC TANGIBLE EVIDENCE CAN BE PRODUCED CAN THE INTERPRETATION BE AMBIGUOUS? IS SATISFACTION DIRECTLY OBSERVED OR IS IT IMPLIED ARE GUIDELINES FOR INPUT CONDITIONS COMPLETE?

CAN UNSATISFACTORY PERFORMANCE PASS ACCEPTANCE?

WHAT MINIMUM PERFORMANCE WOULD BE ACCEPTED BY A COURT?

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INTERFACE DEFINITION PROBLEMS

STATEMENT OF WORK CONFLICTS
CONTRACT TYPE DIFFERENCES
TECHNICAL AMBIGUITIES
SCHEDULE SYNCHRONIZATION

STATINTL

CHANGE CONTROL

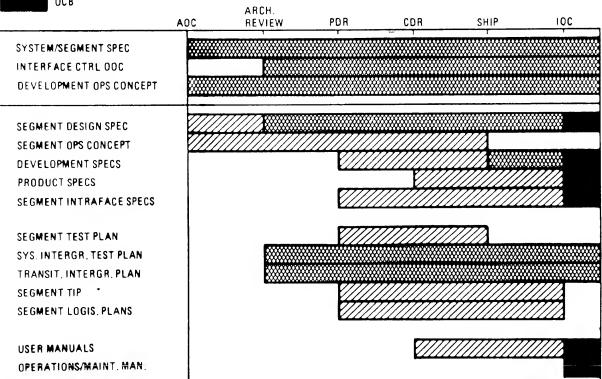
CONTROL RESOURCE PRIORITIES
PREVENT UNNECESSARY CHANGES
ASSURE INTERFACE COORDINATION
PROVIDE ORDERLY INTEGRATION OF CHANGE

STATINTL



Configuration Control Authority





STATINTL

FACILITY REQUIREMENTS

AREA
POWER
COOLING & CIRCULATION

AIR WATER

COMMUNICATIONS
ELECTROMAGNETIC RADIATION
SOUND
INTERCONNECTIONS

STATINTL

INSTALLATION ISSUES

MECHANICAL

STRUCTURAL SUPPORTS
ACCESS CLEARANCE
MANUFACTURING TOLERANCES

ELECTRICAL

CABLE LENGTHS AND ATTENUATION ISOLATION/SHIELDING SWITCHES MODULATION, ENCODING, POLARITY GROUNDING

ENVIRONMENTAL

CONTROL OPTIONS RANGES

STATINTL

FACILITY MODIFICATION CONCERNS

IMPACT DURING MODIFICATION FUNCTIONALITY IN OPERATION SYSTEM DESIGN IMPACT LEAD TIME & INTERDEPENDENCES

STATINTL



COMPLETE SEGMENT TESTS AS REQUIRED

VALIDATE SYSTEM INTERFACES
LAGGING PROBLEM FIXES

DEMONSTRATE KEY REQUIREMENTS SATISFACTION
UNIFY HARDWARE, SOFTWARE, PERSONNEL, PROCEDURES
AND LOGISTIC SUPPORT

STATINTL

SITE TESTING PITFALLS

STRUCTURAL DEPENDENCE ON DELIVERY
SCHEDULES
DATA SOURCES
CONTRACTOR MAINTENANCE
OPERATIONAL IMPACT

STATINTL

TRANSITION TEST OBJECTIVES

ESTABLISH SYSTEM PERFORMANCE WITHIN OPERATIONAL FRAMEWORK

PERSONNEL
PROCEDURES
FACILITIES
LOGISTICS

CONFIRM TOTAL SYSTEM CAPABILITY

OPERATING MODE CONTINUITY
THROUGHPUT
TIMELINESS UNDER LOAD
ERROR DETECTION AND RECOVERY

RECONFIRM CAPABILITIES NOT INTENDED TO CHANGE

STATINTL

TRANSITION TEST PLANNING PROBLEMS

LIEN IMPACTS ON TEST OBJECTIVES

OPERATIONAL IMPACTS

PERSONNEL
EQUIPMENT UTILIZATION
DATA BASE CONTROL

OPERATIONAL RISKS

FAILURE ISOLATION RECOVERY CAPABILITY DATA INTEGRITY

STATINTL

TRANSITION TEST PLANNING PROBLEMS

(continued)

PROBLEM ISOLATION ANALYSIS

OPERATIONAL ROLE

DEVELOPMENT CONTRACTOR ROLE

SIMULATED INPUTS AT EXTERNAL INTERFACES

UNCONTROLLED LIVE SYSTEMS AND DATA

POSTMORTEM

STATINTL

TRAINING

USER

CAPABILITIES
ARCHITECTURE
PRODUCTS
APPLICATIONS

OPERATOR

OPERATIONAL POSITIONS

FUNCTIONS
INPUTS
OUTPUTS
CONTROLS
DISPLAYS

COMPUTER SYSTEMS
DATA MANAGEMENT
SPECIALIZED HARDWARE
CONSTRAINTS OR LIMITATIONS
USE OF DOCUMENTATION

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(continued)

MAINTENANCE

DIAGNOSTIC TOOLS/SELF TEST
FAILURE MODE INTERACTIONS & SYMPTOMS
USE OF DOCUMENTATION

PLANNING FACTORS

NUMBER AND AVAILABILITY OF TRAINEES RECERTIFICATION REQUIREMENTS EQUIPMENT AVAILABILITY

STATINTL

LOGISTIC SUPPORT ELEMENTS

CONTINUING TRAINING AND CERTIFICATION

SYSTEM TRAINING POSITION TRAINING RECERTIFICATION

MAINTENANCE

HARDWARE PREVENTATIVE MAINTENANCE HARDWARE REPAIR SOFTWARE MODIFICATION SOFTWARE REPAIR

SPARES & SUPPLIES

STATINTL

MEMORIZE YOUR CONTRACT

REQUIREMENTS
STATEMENT OF WORK
TERMS AND SCHEDULES

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STATINTL

MAINTAIN USER CONTACT

KNOW HIS NEEDS

KNOW HIS NEEDS
KNOW YOUR CONTRACTOR'S CAPABILITIES
UNDERSTAND COST/SCHEDULE/PERFORMANCE TRADES
SELL YOUR PRODUCT

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STATINTL

NURTURE PEOPLE

VALUABLE INFORMATION SOURCES
LONG-TERM GOVERNMENT BENEFITS
PERSONAL SATISFACTION

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STATINTL

LOOK FOR ASSUMPTIONS

MEANING OF WORDS

GROUND-RULES SIDE EFFECTS

STATINTL

BE FORWARD LOOKING

TOTAL PROJECT IMPACT

DESIGN
PRODUCTION
TEST
LOGISTICS

RIPPLE EFFECTS

DESIGN CHANGES
STAFFING
MILESTONE CHANGES

STATINTL



CONSIDERING:

YOUR MISSION REQUIREMENTS
STATE OF THE ART OF TECHNOLOGY BEING USED
YOUR CONTRACTOR'S CAPABILITIES
HIS MANAGEMENT SKILLS

ASK YOURSELF:

WHAT NEEDS TO BE DONE TO MEET THE NEXT MILESTONE?
WHO'S DOING IT?
DO YOU HAVE REASONS TO THINK THEY'LL SUCCEED?
HOW WILL YOU CALIBRATE THEIR PROGRESS?
DO YOU HAVE ANY ALTERNATIVE OPTIONS?

STATINTL

PRELIMINARY TEST PROCEDURES

TEST OBJECTIVES
EQUIPMENT AND STAFFING
OPERATING PROCEDURES
DETAILED DESCRIPTION
ANALYSIS PROCEDURES
ACCEPTANCE CRITERIA
RELATIONSHIP TO OTHER TESTS

STATINTL

TRANSITION INTEGRATION PLAN

ORGANIZATIONAL ROLES AND MANAGEMENT SYSTEMS SCHEDULES

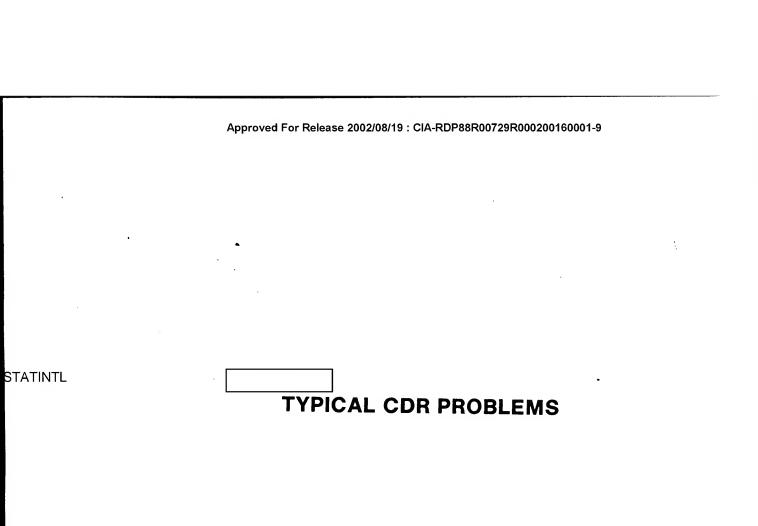
IMPACTS
DEPENDENCIES

BASELINE EVOLUTION

BASELINE CHANGE SEQUENCE INCREMENTAL FUNCTIONAL FLOWS

FACILITY OVERVIEW
OPERATIONAL RESOURCE DEMANDS

PERSONNEL
INTERFACES
SYSTEMS
MISSION IMPACT



STATINTL

DESIGN INCONSISTENCIES

CAUSES

POOR INTERNAL COMMUNICATIONS AMBIGUOUS INTERFACE SPECIFICATIONS INEFFECTIVE MANAGEMENT

CONSEQUENCES

WASTED EFFORT SEGMENT TEST DELAYS

STATINTL

INSUFFICIENT COMPUTER TIME

CAUSES

UNDERSIZED SYSTEM
MISMANAGED RESOURCE
LOW PRIORITY
DEVELOPMENT PLANNING ERRORS

CONSEQUENCES

IMPLEMENTATION AND TEST DELAYS

STATINTL

INADEQUATE TEST FACILITIES

CAUSES

UNRECOGNIZED COMPLEXITY
INEXPERIENCED TEST MANAGER
LACK OF CORPORATE SUPPORT

CONSEQUENCES -

UNUSABLE SYSTEM
INTEGRATION PROBLEMS
PROJECT DELAYS

STATINTL

UNSPECIFIED TEST DATA SOURCES

CAUSES

LATE STAFFING UNRESOLVED TEST TOOLS

CONSEQUENCES

LONG LEAD TIME SCHEDULE IMPACT GOVERNMENT INHERITED PROBLEM LESS RIGOROUS TEST PROGRAM

STATINTL

SCHEDULE AND DESIGN BREAKAGE OF TEST PLANS

CAUSES

DEVELOPMENT MILESTONE SLIPS ENGINEERING OVERSIGHTS REQUIREMENTS CHANGES

CONSEQUENCES

WASTED EFFORT
COMPRESSED TEST SCHEDULE
INCREASED INTEGRATION TESTING

STATINTL

UNTESTABLE DESIGN

CAUSES

TEST APPROACH UNSPECIFIED AT PDR

CONSEQUENCES

INTEGRATION RISK

STATINTL

IGNORING EVIDENCE OF A SLIP

CAUSES

CUSTOMER WON'T ACCEPT TRUTH MANAGEMENT PRESSURE WAITING FOR "GET-WELL"

CONSEQUENCES

CONTINUED SLIPS
POOR MORALE

STATINTL

CONFIGURATION CONTROL

IMPLEMENT MANAGEMENT CONTROL OF PRIORITIES PREVENTS UNNECESSARY CHANGES
ASSURES INTERFACE COORDINATION
PROVIDES ORDERLY INTRODUCTION OF CHANGE